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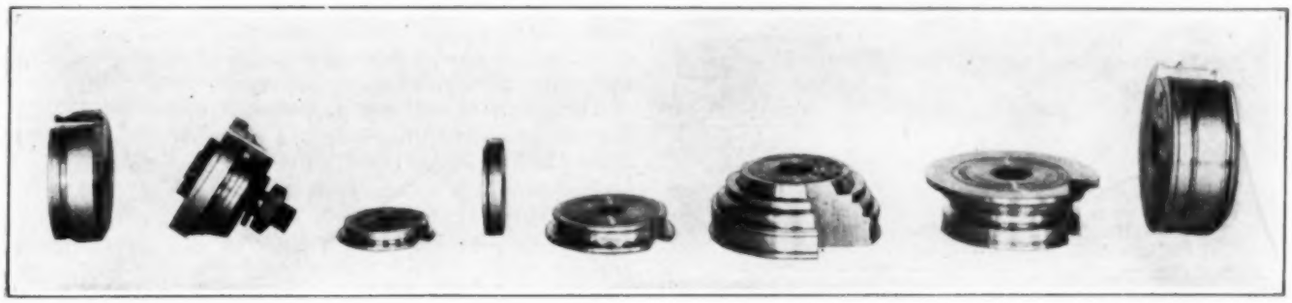


The Form Grinding of Circular Form-Tools

By Ellsworth Sheldon
New England Editor, American Machinist

AMONG the first of many special tools and appliances to be brought into being by the gradual application of the automatic screw machine to mass production, was the form tool. First made by forging a square-nosed tool, laying out the contour on its top and filing to line, it was not long before some genius perceived the advantages to be derived from making the body of the tool in the form of a disk and shaping the contour upon the periphery of the disk by ordinary lathe operations. Thus came about the now well-known circular form-tool, sometimes called a "wheel" tool. When and by whom the first one was made is beyond my ken, but that it was prior to 1888 I can testify at first hand, for in that first year of my apprenticeship it was one of my regular jobs to bore, thread and turn up blanks and get them ready to be shaped and hardened by a more experienced workman. Shapes were simple and forms were narrow in those early days. A round-bottomed groove, a beveled end, or a button or fillister head for a screw, very nearly set the limit of imagination for the designer, who, in ninety-nine cases out of a hundred, was the man who made the tool. Forms several inches wide with complex curves, narrow channels, thin projections and sharp angles were far in the future. High-speed steel was as yet unheard of, and the old "jour" who made the tool also performed the rite—too often the last sad rite—of hardening it at the little forge in a corner of the machine room. After being hardened it would be replaced on the lathe mandrel on which it was made and the contour polished by means of a piece of abrasive cloth held against the rapidly revolving tool by a stick of soft wood. In order to make this finishing operation possible, it was necessary to defer the gashing by which the cutting edge is formed until after the tool was hardened, when the gash would be cut in with an abrasive wheel almost the last thing before the tool went into service. Very good results were, and still are, obtained from tools made in this manner from carbon steels, but the coming of high-speed steels, involving the extremely high heats necessary to harden them properly, brought in-

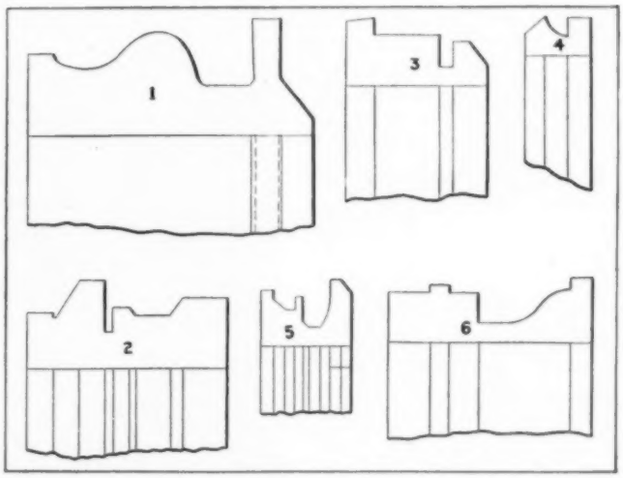


Fig. 1—Contours of circular form-tools that have been finished by grinding. The tools are first roughed out in the lathe in the usual way and are hardened before the final operation of grinding the contour is performed. This method, therefore, insures against loss in hardening

The first of six articles. The second will appear in an early issue.

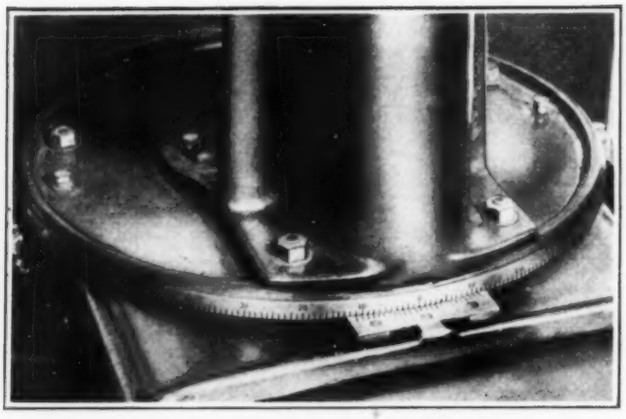


Fig. 2—The base of the wheelhead upright is graduated in degrees and is provided with a vernier to read to five minutes of arc. When set to a given angle, that angle may be dressed accurately upon the grinding wheel

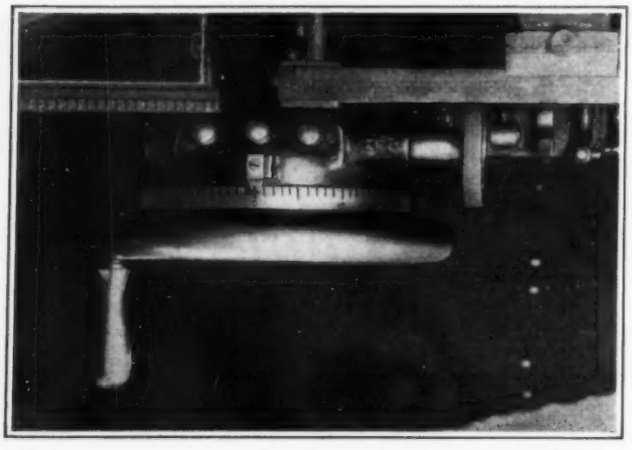


Fig. 3—A micrometer dial upon the the cross-feed screw is graduated in 100 divisions, each division indicating 0.0005 *in. advance of the wheelslide, or one full thousandth over the diameter of work in contact with the wheel*

creasing difficulties. Shapes became much more complex, and the thin projections, sharp corners, etc., of the later forms—difficult enough of preservation through the comparatively mild processes of hardening ordinary steels—would be burned away, sometimes to the extent of making it impossible to restore the contours by the old method of polishing. Now, however, thanks to the modern grinding machine, such shapes can be restored or even produced entire upon the plain blanks after the heat treatment is an accomplished fact.

By courtesy of the Brown & Sharpe Manufacturing Company the writer has been privileged to study the methods applied by that company to the form grinding of form-tools for use in its shops and to order for other concerns, and to make photographs at various stages of the work to show toolmaking readers of the *American Machinist* how to grind similar tools in their own shops. There is no secret about it; it is merely the application of skill and experience, plus accurate machines and modern grinding wheels.

The contours shown in Fig. 1 represent actual tools that have been made and can be duplicated by any good toolmaker who will devote the small amount of time necessary to acquire the special knowledge possessed by the men who regularly do this work. The only thing approaching the nature of a "secret" about the job is the fact that the complementary forms are made first *upon the wheels,* and are then reproduced upon the work by the aid of the accurate special adjustments of which the machine is capable.

This does not mean that the whole complementary form is made on one grinding wheel at once, but that the shapes necessary to produce the several channels, angles, curves, etc., are made upon a corresponding number of wheels—or upon one wheel successively if more convenient—and transferred one or two at a time to the work. The formation of the shapes on the wheel or wheels, and their transference to the work in proper relation to it and to each other, is almost entirely a matter of reading micrometer dials and vernier scales correctly.

Though it is entirely possible to produce the whole contour of any form-tool upon a plain hardened blank, it is not ordinarily done. Such a procedure would cause loss of time and undue waste of wheels. Except in the case of very narrow channels—$\frac{1}{32}$ in. and less in width—the tool is first shaped in a lathe by ordinary methods, leaving from 0.008 to 0.015 in. grinding allowance. Channels from 0.015 in. to $\frac{1}{32}$ in. wide by anything up to $\frac{1}{16}$ in. deep are, however, ground from the solid in the hardened blank.

To form with a grinding wheel a contour consisting of straight lines intercepted at definite distances by angles of various degrees, or blending into curves and fillets of different radii, when these distances, angles and radii are set forth upon a drawing to within 0.0005 in. limit of error or a variation of five minutes of arc as the case may be, is a job that involves both mathematical calculation and the application of precision measuring instruments. The mathematics are, however, well within the grasp of any toolmaker who has a working knowledge of trigonometry and the measuring instruments are incorporated in the machine upon which the work is done.

The machine used at Brown & Sharpe's to form grind form-tools is that company's own No. 13 universal and tool grinding machine. It is too well known to need extended description here, but a brief reference will be made to some of its salient features so that the reader may understand the various movements and settings that have to be made, and the means of making the accurate measurements involved, without recourse to other sources of information.

The circular base of the wheelbase is graduated in degrees and swivels about a vertical axis through a range

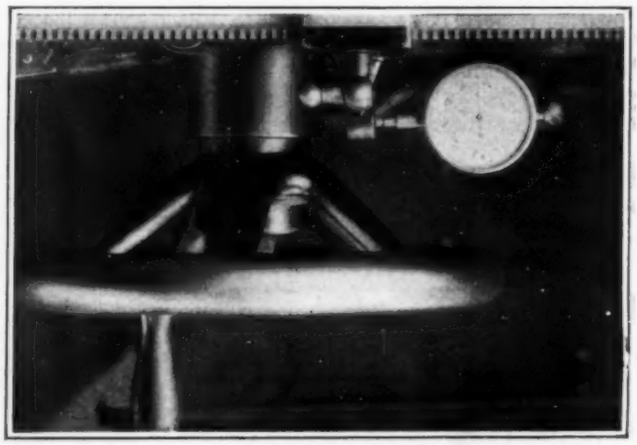


Fig. 4—To accurately measure small traverse movements of the table, a movable dog is adjusted to bear upon the spindle of the dial indicator here shown. Minute movements may be read directly from the dial in thousandths

of 90 deg. either way from zero. A vernier, shown in Fig. 2, permits settings to be made to five minutes of arc. Rising from the graduated base of the wheelhead is an upright, on the vertical face of which is a slide, or carriage, with the wheel spindle mounted directly upon it. This carriage has a wide range of vertical movement, hand operated and actuated by a screw rotated by means of a small graduated handwheel at the top of the upright.

The wheel spindle is double-ended and swings two 7-in. wheels. It is parallel to the line of traverse of the work table when the graduated base of the wheelhead is in zero position.

The wheelhead is carried on a cross-slide having a screw-operated movement in a direction at right angles to the line of traverse. The cross-feed screw is rotated by a handwheel on the front of the machine. Behind the handwheel, as may be seen in Fig. 3, is a micrometer dial that is graduated in 100 divisions, each division representing an advance of 0.0005 in. of the slide, or one full thousandth when measured over the diameter of a tool presented to the grinding wheel.

Above and at a right angle to the handwheel is a small wheel which engages the cross-feed screw through a worm and wormwheel having a reduction ratio corresponding to one full turn of the small wheel to each division of the micrometer dial. Thus the operator knows that one turn of the small wheel will reduce the diameter of his work 0.001 in. and he can make this reduction with certainty without taking his eyes off of the job. This mechanism can be engaged and disengaged from the cross-feed screw at will.

The traversing table has all the movements and adjustments of that important part of any universal cylindrical

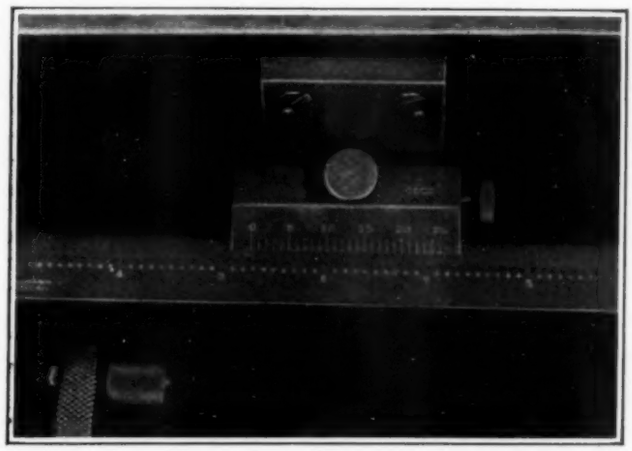


Fig. 5—To measure longer distances of traverse, this scale is fixed to the base of the machine and a vernier is attached to the table. With the vernier adjusted to coincide with a division of the scale, movements in either direction may easily be read

grinding machine, including the swiveling feature employed to grind tapers, but we are concerned here principally with the means provided to measure accurately its endwise movements over comparatively short distances. These provisions are two in number: that shown in Fig. 4 being a dial indicator and adjustable dog; and in Fig. 5 a fixed scale with a movable vernier. From the front view of the machine, Fig. 6, the relative positions of the parts may be seen.

The standard on which the dial indicator is mounted is fixed to the cabinet base of the machine, while the dog

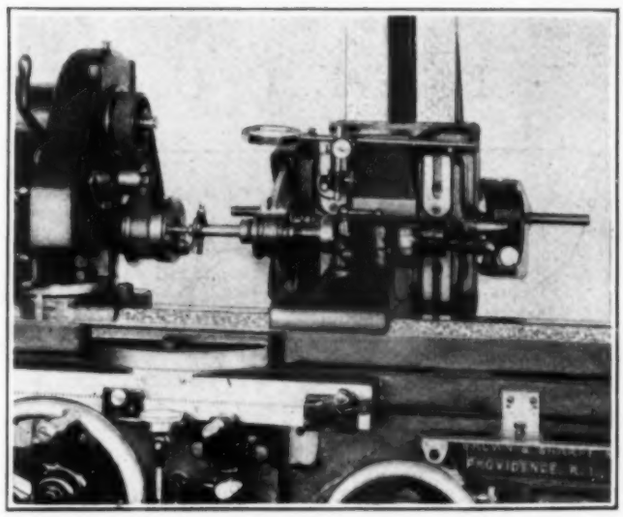


Fig. 6—This view shows the relative positions of the controls. The handwheel at the right moves the cross-slide, while that at the left traverses the table. Fast and slow traverses are available through gears shifted by the lever behind the handwheel

that abuts against its measuring spindle is movably attached to the traversing table. If it is desired to move the table to the right a specific distance, the dog is adjusted in contact with the spindle to lift the pointer of the indicator slightly against the action of its spring, and is then clamped to the table. The dial of the indicator is rotated to bring the zero under the pointer. Any movement of the table to the right will now be shown on the dial in thousandths of an inch.

If the desired movement is greater than the capacity of the indicator to measure it, a gage block of the required size is interposed between the dog and the spindle of the indicator when making the setting. With the block removed, the movement of the table will then be equal to the thickness of the block plus the dial reading.

It is obvious that a movement of the table to the left may be gaged with equal accuracy by setting the dog against the spindle of the indicator to bring the pointer up to the desired reading and then moving the table to the left until the pointer returns to zero; again interposing a gage block of the required thickness after the dog has moved away from the spindle if the movement is beyond the unassisted capacity of the indicator. To measure short distances—as from shoulder to shoulder on a circular form-tool—the operator uses the dial indicator by preference, as it is more easily read than the vernier, but when the distances are beyond the range of the dial he usually resorts to the vernier. With the table in position to grind any given shoulder, he adjusts the vernier to some convenient major division of the fixed scale, when any movement of the table in either direction may be read directly from the scale.

With either dial indicator or scale and vernier, measurements are regularly made within one-half thousandth limit of error. Magnifying glasses and clamps to hold them are provided at all points where close observations are necessary. Endwise movement of the table is imparted by means of the handwheel to be seen at the left in Fig. 6, which may be engaged directly with the rack for rapid movements or through a reducing train of gears when fine settings are to be made. A lever above and behind the handwheel effects the change from fast to slow movement and vice versa.

Tipping the P. A.

"MR. HOLLAND, the question we want to put up to you today doesn't sound much like one of the problems you are supposed to know the answer to, but it's got me stumped and I must take some kind of action." Edgar Winthrop, president of the Winthrop Manufacturing Company, was sitting in his office with Holland and the company's purchasing agent, George Harrington. Holland had put in a day a month with this company for several years, to the satisfaction of all concerned. The company was not large enough to support much of an engineering department and consequently profited greatly from Holland's experience.

"That sounds good, Mr. Winthrop," replied Holland with a cheery grin. "Anything to relieve monotony. That's why I find this half-baked consulting of mine such fun. There's always something new and different coming up to be studied. But what is it, something worrying George?"

"Exactly. George has been purchasing agent for us for six months and he's learned more about the seamy side of business in that time than he bargained for. He has begun to understand why old Diogenes, with whom he got quite familiar in college, had such a time hunting for an honest man. I'm afraid he's come to the conclusion that no such animal exists, among the selling fraternity, anyway."

"No, Mr. Winthrop, it isn't quite as bad as that, but it's bad enough. Mr. Holland, why is it that salesmen seem to think they can get orders from me by sending me presents and inviting me to go on parties? I'm not averse to parties, but I don't see why they should be mixed up with business. If their stuff is any good why don't the salesmen handle it on its merits?"

"Now you've asked me something I can't answer. I don't know why they don't, unless they think that the purchasing agent doesn't know anything about quality and service, and buys only on price." Holland looked sharply at the young man to see how this would sit. He was not disappointed. Harrington's face reddened slightly.

"Perhaps I don't, Mr. Holland. But I did study engineering in college, and I didn't bust out. And, besides that, when I have any doubts about anything I have to buy I get the superintendent to check me on it."

"Keep your shirt on, son. I didn't say you were that kind of a P. A. I said that perhaps the salesmen thought you were. Now, tell me, just what has happened lately to stir this thing up."

"Well, sir, last month we celebrated our fifth wedding anniversary. Somehow or other, three of the salesmen that call on me found out about it and on the day before the party the express company left at my home a fine dinner set, an all-electric radio and a case of Scotch."

"Well?"

"We have all the china we need, I don't drink Scotch and I got a radio for Christmas from my father."

"So those gifts were wasted on you?"

"Yes. I don't know what to do with them. And, what's more, I feel as though I'd been bribed, which is bad enough, or tipped, which is worse. I'm no head waiter."

"I know just how George feels," broke in Winthrop. "The same thing happened to me a good many years ago when I was working for the Pleasant Valley railroad. But what can we do about it?"

"Why not send a letter to the sales manager of every concern that has sent a salesman to see you and explain that you buy material on its merits and that your purchasing agent does not accept presents of any sort. The chances are that such a plan might work."

"Yes, it might," agreed Winthrop. "But it seems to me there ought to be more ethics among sellers, and purchasing agents, too, maybe. It ought not to be necessary for me to write any such letter. Why should I have to explain that my

purchasing agent and my company are on the level?"

"You shouldn't, of course, but you can't change human nature over night. We can both remember, I guess, when it was the usual thing for sales to be made in an atmosphere of wine, women and song. If you think up any way of speeding up the reformation let me know. I'd like to get in and help. What's next?"

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Setting Prices on Special Machines

When a manufacturer submits quotations on lots of different sizes, he is quoting several times for one job, and if then the customer comes back regarding tools, and a further quotation is made, does it not become clear that the manufacturer has been giving the buyer very valuable engineering service without any assurance whatever that he will get any compensation? Is it any wonder, then, that buyers take advantage of manufacturers and get engineering service totally free of cost?

I have also found many occasions where the buyer submits blueprints for quotations, with incomplete details, such as material or heat-treating specifications or finish requirements and tolerances, so that by the time the manufacturer has developed these, he has so far educated the buyer that the latter not infrequently decides to do the work himself. —J. H. STERNBERGH, *Manager.*

Keeping Machines Running

After having been plant engineer for a corporation having 30,000 employees, from experience I know that a repair policy may apply to a particular line of manufacture while the same policy may not apply to the machinery employed in another line. The general cost of repairing machinery in the metal-working field is greater than it is on machines used in woodworking.

I once built a machine to do a certain operation at a cost less than the price quoted by a jobbing shop to remodel an existing machine. This home-built machine paid for itself in four days. In another case we took an old machine from the "bone yard" which originally cost $172, spent $266.80 for material and labor to put it in condition, and found that we had no machine in our shop that could be speeded up to equal the output of this "old wreck." In still another case on a conveyor costing $1,365, something over $1,500 has been paid for labor and material in 4 years to keep this conveyor going, but as the conveyor has saved the labor of seven men in doing the material handling, the firm using it is well satisfied with the cost of the installation.

Repairing and maintenance of equipment and machinery is a broad subject, and includes such a variety of cases of this kind that the subject is a very indefinite one. Therefore, the attempt to formulate a definite policy that will cover any and all lines of machines is out of the question. —F. H. STEBBINS.

What Is Overhead?

The fact should never be lost sight of that 100 or 500 per cent overhead is merely the expression of a ratio, and that if an increase in the values classed as overhead tends to lower the base, the net result is commendable and not to be deplored. When Berger proposed the possibility of building up his overhead charge from "total plant cost" or "total cost of product," I suppose that he meant to set up the percentage of a total cost from which direct material and direct labor had been subtracted, as his overhead, but this would be merely another way of showing up the comparison while in no way affecting any of the values involved. The whole matter seems to be summed up in Mr. Holland's statement about "understanding what it means." —D. C. WRIGHT.

About Wage Incentives

On page 641, Vol. 68, of the *American Machinist*, William C. Boston advances some logical arguments in support of the proposition that piece-rates should not be guaranteed against being changed, and he gives some instances in which he believes rates should be cut.

Aside from considerations of justice and fair play, it is a question whether a piece-rate, subject to reduction for any of the reasons given by Mr. Boston, would continue to act as an incentive to the operators to increase their production. For instance, it is claimed that the rate should be cut when it is found that the rate-setter has made a mistake. How do we know when he has made a mistake? Why, the answer is, when an operator makes too much money on the job! Under that system, it will not take the men very long to discover the limit of what they can earn without having their rates investigated.

In the last analysis, any piece-rate system is a device designed to stimulate the workman's interest in his job. Handling the system in a manner that ignores the mental reaction of the man, may easily kill that interest and produce only discouragement. —C. S. HAZARD.

CHRYSLER PARTS
Heat-Treated Semi-Automatically

By FRANK W. CURTIS
Western Editor, American Machinist

Automatic time and temperature control reduces the amount of rejected work, increases production, and lowers heat-treating costs of miscellaneous automotive parts

MOST OF THE PARTS requiring heat-treating at the Chrysler Corporation's Detroit plant, are handled in semi-automatic furnaces. These units eliminate guesswork and insure uniformity in the finished parts. Compared with the older types of furnaces that required constant watching and checking, the semi-automatic equipment creates many savings. Once the required heat-treating specifications of a part have been determined, it is only necessary to adjust the automatic pyrometer control and conveyor speeds to suit them, and then to explain the required duties to an average operator who can produce results equal to, or perhaps better than, a thoroughly experienced heat-treater. The use of semi-automatic equipment reduces rejected work to a minimum with the added advantage of lowering heat-treating costs.

Some of the furnaces operate automatically, aside from the loading of the work, the cycle including transportation of the work through the heating chamber, the time limit of heating, the control of temperature, and quenching. Others require a hand operation for quenching. Features common to the three units described here, however, are automatic temperature controls and automatic feeding which, of course, controls the time.

Rear-axle shafts made of S.A.E. 3435 steel are heated in the furnace illustrated in Fig. 1, which shows the loading end. The work rests on two rails that project forward to form a loading platform, and which also extend through the chamber. The shafts are separated from one another by spacer blocks that fit in the slots of the rails. Movement of the work is controlled by the pusher plate, shown resting on the rails, which in turn receives its reciprocating movement through a worm-gear reduction drive and crank arm located directly under tne loading platform.

The unloading end of the furnace is shown in Fig. 2. Here the work is quenched automatically in an oil bath as it passes from the heating chamber, and then is picked up by a conveyor and ejected into the platform box shown at the right. Passing the shafts upward on the conveyor allows most of the oil to drain off, putting the work in a cleaner condition, as well as effecting an economy in oil since drippings pass back into the quenching tank. The shafts are heated at 1,550 deg. F., and 45 min. is required for them to pass through the furnace. A shaft is completed every 40 sec. A similar furnace used for camshafts, made of S.A.E. 1015 steel, may be seen at the rear in Fig. 1. For these parts, however, the heating duration is 1¼ hr. at 1,500 deg. F., and a piece is ejected every 1 min. and 25 sec. Water is used as a quench.

Differential gears and pinions made of S.A.E. 3115 nickel steel are heat-treated in the furnace shown in Fig. 3, which carries the work through by means of a

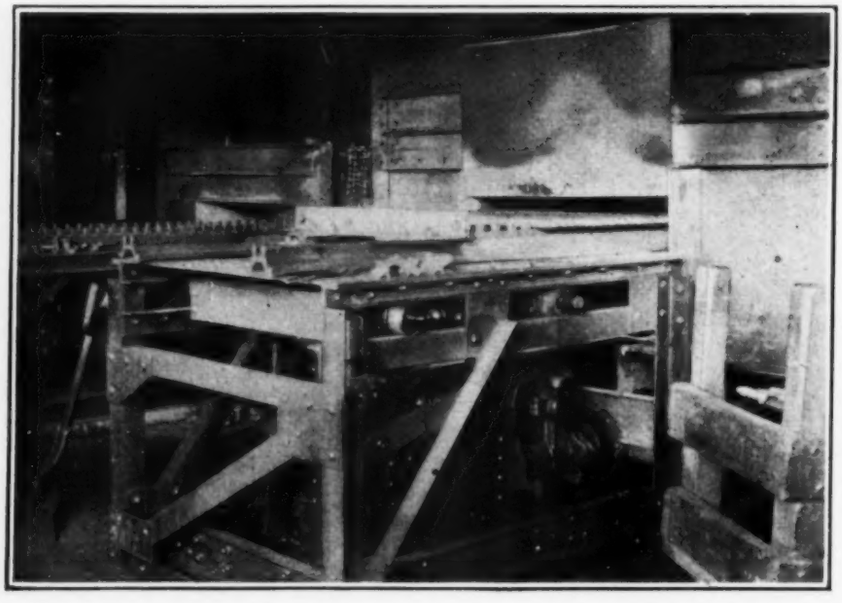


Fig. 1—A semi-automatic furnace for hardening rear-axle shafts. The work is placed on two rails, separated by spacer blocks, and pushed through the furnace by a plate that is driven by a reduction-gear unit and crank arm

The axles are heated at 1,550 deg. F. and then quenched in oil. A shaft is completed every 40 sec. and approximately 45 min. is required for heating each one

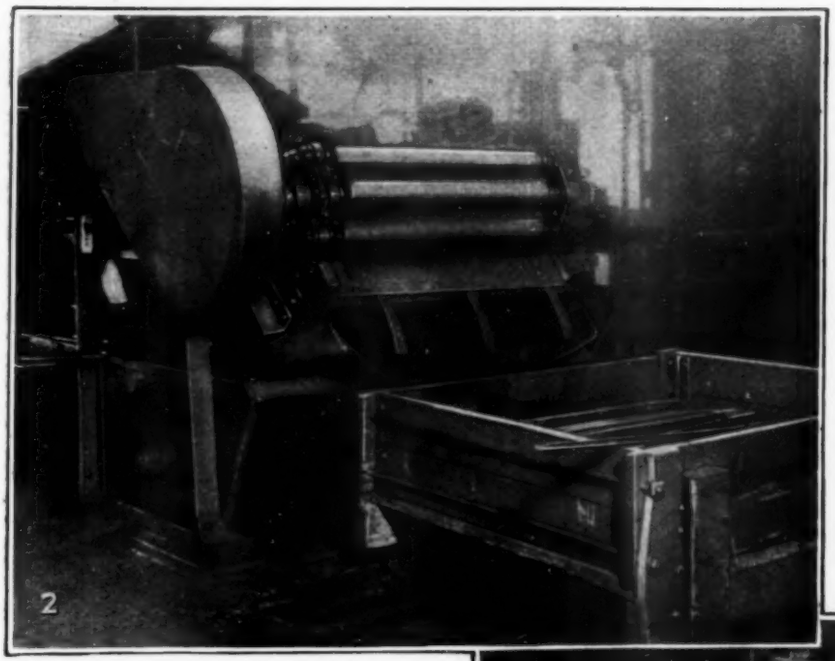


Fig. 2—The ejecting end of a furnace for heat-treating rear-axle shafts showing the method of taking the work out of the oil baths. The conveyor is built over the quenching tank, so that oil from the work can drain back into it for re-use. Finished shafts are ejected into the box shown at the right. A similar furnace is used for heat-treating camshafts

Fig. 3—In heat-treating differential gears and pinions, the work is placed on racks which in turn are pushed into the furnace chamber. Power driven rolls then feed the racks through the furnace automatically. The chamber accommodates seven racks, each of which holds 40 gears. The heating temperature is 1,425 deg. F., and it takes 45 min. for the work to pass through the furnace. The material is nickel steel

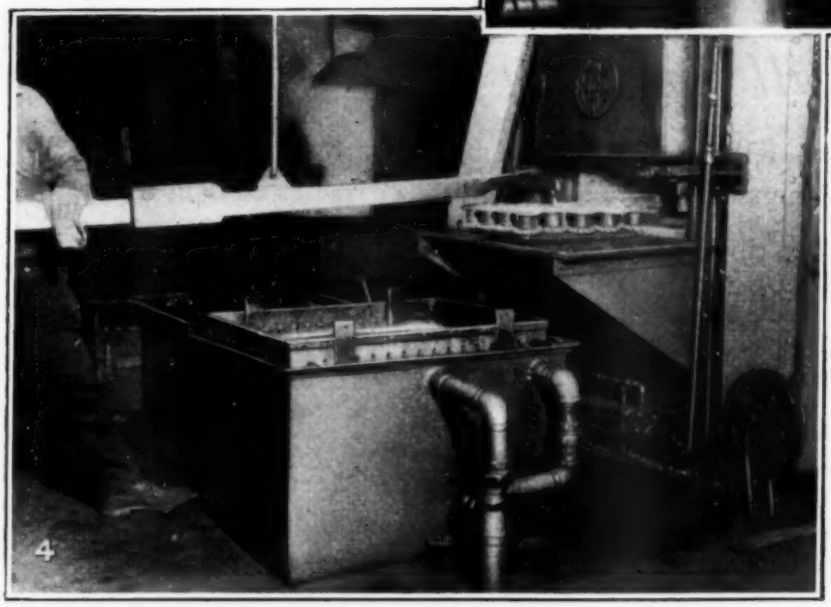
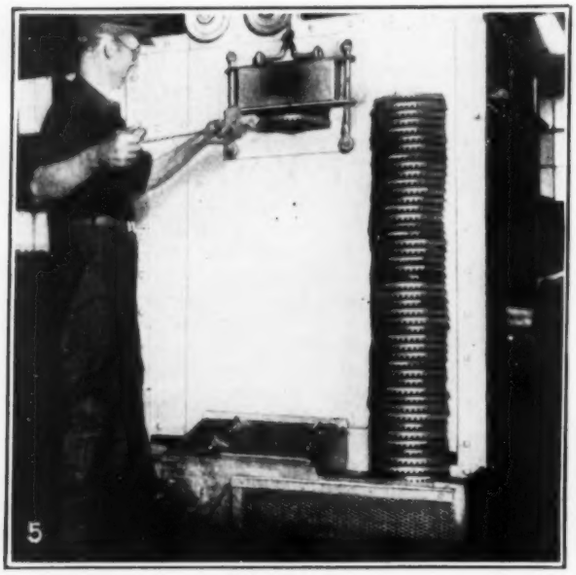


Fig. 4 — An operator preparing to quench a rack of differential gears at the opposite end of the furnace. When the work reaches the discharge end it makes contact with an arm that strikes a bell indicating that the charge is ready for quenching. The furnace door is air operated and is controlled by the treadle shown at the left. Following this treatment the gears are drawn in oil



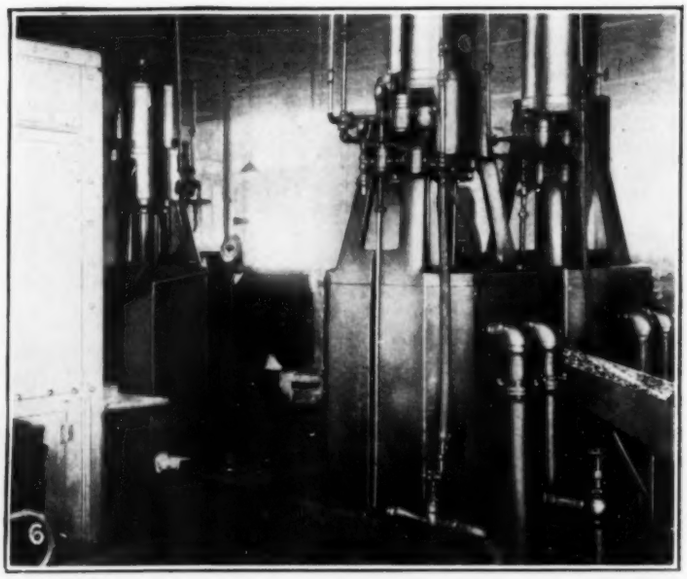


Fig. 5 — One of the furnaces used for heating ring gears to 1,450 deg. F. The chamber of the furnace holds 53 pieces and 1 hr., 12 min. is required to complete the heating cycle. The work is placed in at the bottom of the furnace and is taken out at the top. A red light is flashed when a gear is ready to be removed. Fig. 6—Four gear hardening machines are used to quench ring gears, two of which are used for each furnace. The equipment is laid out at four sides of a convenient working area and the operations required are handled by two operators. Elimination of warpage is obtained by use of the hardening machines, insuring the work being held to close tolerances

series of rollers driven by a variable-speed unit. The work is loaded on racks, holding 40 gears each, which in turn are pushed by hand into the heating chamber. Seven racks are accommodated in the furnace, each of which remains inside for 45 min. A heat of 1,425 deg. F. is required. The gears are quenched as shown in Fig. 4. The operator pushes a treadle to open the air-operated furnace door, reaches for the loaded rack with the lever, and then quenches the charge in the oil tank located in front of the door. A feature of the furnace is that when the load reaches the discharge end it makes contact with an arm located in the chamber which in turn rings a bell indicating that the load is ready for quenching. One man attends to the entire operation of the furnace, as well as handling the drawing operation carried on close by.

Two furnaces such as the one shown in Fig. 5 are used to heat ring gears, made of chrome-vanadium steel, S.A.E. 6115. The work is loaded at the bottom, passes through the heating chamber automatically, and is taken out ready for quenching at the top. The unit holds 53 gears, and it takes 1 hr., 12 min. to complete a heating cycle. Quenching is done in paraffine oil by gear-hardening machines of which four are in use as shown in Fig. 6. Two machines handle the output of each furnace, and these are used alternatively. Finished gears scleroscope between 75 and 80, the bores are held to a limit of 0.003 in., and the back face must be flat to within 0.002 in. Previous to this treatment the gears have been carbonized at 1,650 deg. F. for 11½ hr., and the next operation is drawing in oil at 450 deg. F., which is followed by a sand blast preparatory to grinding.

You will find next week:

Another of the Ford articles—telling of the production of the transmission.

The first of two articles describing tools and devices used in the repair shops of the Southern Railway.

A story on "Co-operative Design," dealing with the factors influencing the design of bearings, gears and drives.

The report of a Czechoslovakian engineer concerning experiments performed to determine the character of tight and force fits of the German D.I.N. and Skoda Works systems.

The second of the form grinding series, telling how circular form tools are ground.

The third article, "Meeting the Problems of the Contract Shop."

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Should He Report Another's Error?

"HERE'S a queer case, Al. One of my friends, who is foreman in a railway shop, found an air motor among a lot of scrap sent in from another shop. The motor was almost new, and perfect except for a small part that was missing —and they found the part inside when they opened it. How do you account for that, Al?"

"Guess some inexperienced operator tried to take it apart, found he couldn't get it back together, dropped the piece inside, and put the cover on. Then he threw the motor in the scrap to hide his ignorance. What's the rest of the story, Ed?"

"Not much, only my foreman friend fixed it up and now he has an extra air motor. But he doesn't dare tell the M. M. because if they find the chap who did it they'll fire him. They'll also bawl out the other foreman. So he has to hide the motor whenever anyone tries to check up on equipment, or take an inventory. What do you think he ought to do, Al?"

"Rather a hard case to decide, Ed. Theoretically, of course, he ought to report it, because a man who will throw a good motor in the scrap ought to be fired. On the other hand such a man is probably an ignorant chap, or he'd have known how to put the tool together, and the poor devil needs the job even more than a good man, who could get another one much easier. But his foreman should have missed the motor, seems to me."

"That's the way Bill figures it out. He knows he ought to report it—yet he hates to do so. What would you do, Al?"

"Guess I'd probably report it, Ed. Our first duty is to the company. But I might sort of hope that they wouldn't find out who the man was."

"Any chap who would do a thing like that ought to be fired, Al."

"I'm not defending him at all. He deserves punishment, of course. But he's probably got a wife and kiddies who might go hungry. You see, Ed, it isn't as though the company had really lost the air motor. It's just shifted from one shop to another, and is more a matter of bookkeeping than anything else, so far as company property is concerned."

"I think he ought to be fired anyhow, Al. No use wasting sympathy on a man like that."

Is Ed right in recommending discharge in all such cases? Is Al's wish that the culprit may not be found justified? Is the company really losing as much as it might seem?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Putting Color on the Machinery

MOST persons will greet the use of color in the shop with enthusiasm for it will suggest more natural surroundings. Colors cause satisfaction with the environment and help to enliven people. So let the machines be painted in bright colors, taking care to prevent glare, cheap appearance, or that oil and dirt upon them spoil a fine effect. The expense will be quickly returned by the increased quantity and quality of the work. —W. H. HOAGLAND.

PAINTING the machines in a shop will do much to relieve the effect of depressing surroundings, and will tend to prevent eyestrain. People respond to harmonious color schemes so that additional vigor is released, and an evident snap is apparent in their actions. Why not take advantage of this fact to raise production if for no other reason?

Caution must be observed in choosing colors. It must be borne in mind that bright glossy paints should not be used where they cause a glare in the workers eyes. Tints should be so chosen that they will not in time present a more ugly appearance than the originally lifeless black. Uniformity in color scheme for a department is necessary to create the most pleasing appearance.

—H. KAUFMAN.

Getting the Wear Out of Machines

USUALLY a shop's business is good just so long as it is able to give better delivery dates than its competitors. Therefore, when every machine is needed, it is very expensive and inconvenient to use two machines instead of one for a job because it is feared that one would be overloaded. Abuse is more likely to ruin the tool than heavy use. If a definite system of repair is in effect, the machines should hold up for a reasonable time. When the old machines are finally worn out, new machines may be purchased, which because of their many improvements and greater capacity will further aid in keeping several jumps ahead of rivals.

—C. H. WILLEY.

NO MODERN machine tool actually goes to pieces or reaches the condition of uselessness all at once. Certain parts such as ways, spindle bearings, lead screws, or gears, depending largely on the nature of the work done, become worn to the point of requiring replacement, while the bulk of the machine is still practically as good as new. Hence, if one is to follow out Williams' plan, it would be necessary to scrap a tool that was still fairly modern and was, for the most part, in good shape. Unless there has been a very sensational development in the field represented by the tool, I doubt the economy of replacing within the time required to wear a machine out to the point of inaccuracy which can easily happen after a few difficult jobs when running at exceptionally heavy feeds and speeds. —D. C. WRIGHT.

THE · NEXT · TOPIC

Making the New Planers Pay

ADVANCE QUESTION

Al tells what two of the men said about the new planers after reading in the "Shop News" what they cost. Ed can't see why the cost should interest the man who uses it and doubts if it really does.

Promoting Interest Among the Boys

WHEN a boy starts work in my department, I spend the first two or three hours with him in an effort to become acquainted. In that time, I endeavor to explain to him just exactly what I expect of him, and what the organization means to me. I try to find out his ambitions, and if he has not any very tangible ones, I point out certain things that he may aspire to easily. In addition, I make a special effort to enlist his participation in company activities of an athletic nature, since I believe that as his acquaintance widens his interest will be aroused. I have found that it is very difficult to interest boys and young men in the policies of the organization, but as they grow older and achieve a definite place they begin to think more of these things. —KARL NIXON.

Something Besides the Pay Envelope

EVEN though the pay envelope is of prime importance, I believe there must be some other interest in a job to the average man. One means of stimulating interest in the work is by giving concrete information about the real conditions surrounding it. I do not believe that the average man knows or even thinks seriously of what it costs to break or spoil a job, and he never considers that he pays for part of that loss. Furthermore, the average man hardly ever thinks of how much more or how much less work he spoils than the man next to him. Why not follow the practice of some plants that have charts visible in the workroom which show the percentages of good work and the quantity spoiled.

—R. Q. TARBUTTON.

Fig. 1—Showing use of the ring magnet for removing steel from an eye

Preventing and Caring for Industrial Eye Injuries

By SANFORD DEHART

Director of Hospital and Employment Departments
The R. K. LeBlond Machine Tool Company

INDUSTRIAL eye injuries are costing industry a prodigious sum each year. Eye injuries cost New York State in one year $1,000,000 for compensation, and Pennsylvania has not fared much better, as this state paid out $800,000 for the loss of eyesight due to industrial injuries in one year, and more than $8,000,000 since the enactment of the State Workmen's Compensation Act. Pennsylvania, and of course this means the employers of the state, has paid out more money as compensation for loss of eyes than for all other accidents combined. Three hundred and five eye losses cost the state of Pennsylvania in compensation as much as it would cost to compensate for 133 lives. The National Committee for the Prevention of Blindness found as a result of its recent survey, covering practically every industry and state in the Union, that the annual loss to industry through eye accidents exceeds $23,000,000. The most encouraging thing about industrial eye injuries is that for the most part they are preventable by a reasonable amount of care.

The work done along safety lines in eliminating industrial eye injuries during the past ten years has not been confined to the large shops; the small shops have benefited enormously by utilizing the principles which have been applied in the large shops.

The activities of the United States Steel Corporation in the prevention of eye injuries are truly admirable, and the results it has obtained are nothing short of miraculous. There are 44,000 pairs of goggles in use by the employees of this company which are furnished free. The safety work with reference to preventing eye injuries in this corporation does not stop with the furnishing of goggles. Educational methods devised by the company for the preservation of eyesight, and the installation of safeguards together with a long study of the hazards of the steel industry has made it possible to do away with goggles in many operations of steel making. This corporation has reduced its eye accidents more than 60 per cent in the past ten years, and more than 6,000 eyes have been saved.

Another steel mill employing 9,000 men is saving about $60,000 a year in compensation as a result of its

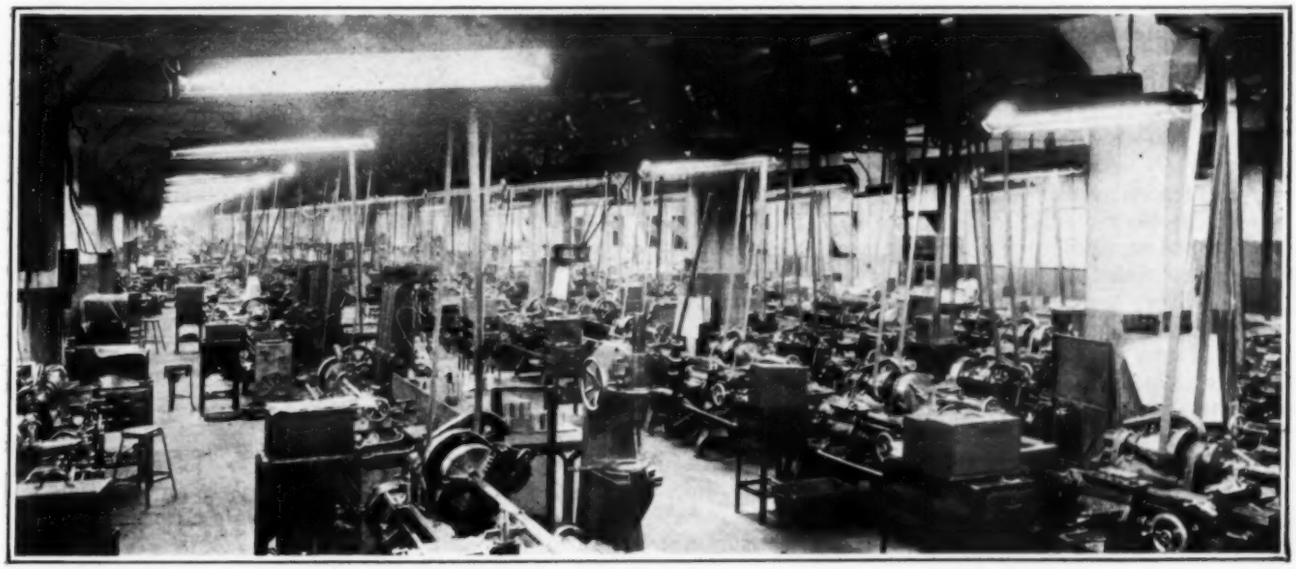


Fig. 2—This type of lighting equipment provides ideal illumination for machine operations

safety activities in preventing eye injuries. In this company safety devices of various types were designed after a thorough study of the accident possibilities of each operation of steel making. Goggles are worn by men chipping while plate-glass shields are used on machines to protect the workers from flying chips. Masks are worn by men pouring metal. Special goggles of various types are worn by welders, furnace men and others exposed to intense light. Burlap screens are used in certain places to protect persons passing by from flying chips. Many other companies could be cited to illustrate the success that is possible where a sincere effort is made to prevent industrial eye injuries.

Grinding wheels offer many possibilities of danger, but they can be so equipped and safeguarded that very few accidents will occur. Take a leaf out of the state factory inspector's book and observe the following items that he looks for when he visits your shop, and not only eye injuries but other injuries as well will be greatly minimized. They are as follows: speed, mounting, vibration, work-rest, hood, exhaust system and eye protection. If hazardous conditions exist in any of these particulars, changes should be made as far as possible, and these are usually effected without much difficulty.

It happens occasionally in industry that many eye affections are due to obscure conditions. To illustrate; for several years the silk manufacturers were losing thousands of dollars owing to employees in the silk industry suffering from incapacitating eye affections, which were thought to be caused by the emanations of hydrogen sulphide emitted in the manufacture of silk. One industrial manager was not quite satisfied that these eye affections were due to hydrogen sulphide. This person engaged an investigator who was able to show that the inflammatory eye conditions were due to another chemical not unlike some of the war gases, which he was able to suppress by improved ventilation.

Acid Eye Burns

A condition that is frequently met with in the machine shop is that of the possibility of receiving caustic and acid burns to the eye which often result disastrously, if the proper precautions are not taken. The National Safety Council's Safe Practices Pamphlet No. 25, presents valuable information concerning first aid for such accidents. They are as follows:

For acid burns such as those of nitric, sulphuric, hydrochloric, acetic, oxalic, and picric (for oleum, first wipe off oleum with clean cloth)—bathe freely with water and apply a saturated solution of bicarbonate of soda.

For alkalis—caustic soda, ammonia, lime and soda ash—bathe freely with water and then apply a two per cent solution of acetic acid.

For hydrofluoric acid, bathe freely with water, then with alcohol or a solution containing equal parts sweet oil and lime water.

For hydrocyanic acid, wash with water, then with hydrogen peroxide.

Alkali burns from lime, lye and ammonia are perhaps best neutralized by ordinary sugar water which forms an inert saccharate, and is employed in the strength of about one teaspoonful to the pint and used as an irrigation. It is especially important to evert the lid and remove every particle, because if left behind the lime comes in contact with the eye and further burns the cornea. Copious irrigations of cow's milk is of value in preventing destructive burns to the eye, due to lime infiltrations. Where there is danger from chemical accidents, water should always be available for washing the acid or caustic agent from the eyes.

Machine shops are finding that electric magnets are of inestimable value in removing steel from the eye. There are a number of very excellent types on the market. There is the ring magnet shown in Fig. 1, and the different portable magnets, an example of which is shown in Fig. 3. The latter are supported from cranes which renders them more flexible for manipulation. These magnets are admirably suited for industrial eye work. Another desirable feature is that they do not require a rheostat to operate them. There are also several hand magnets on the market which have plenty of power, but they all seem to have the disadvantage that they are inclined to heat too quickly.

Another step forward in industrial eye work was the introduction of a preparation called butyn, which is gradually displacing cocaine in industrial plants. Industrial physicians, eye specialists and other investigators have found that butyn causes fewer infections than cocaine. Butyn is a solid synthetic compound manufactured from coal tar, and is soluble in its own weight in water. It possesses important advantages over cocaine: no narcotic blank is necessary; the anesthesia is produced more rapidly and is more lasting. It does not dilate the pupil of the eye as cocaine often does, nor does it cause any drying of the eye. It is not decomposed by boiling the solutions. It is antiseptic and its solutions keep well.

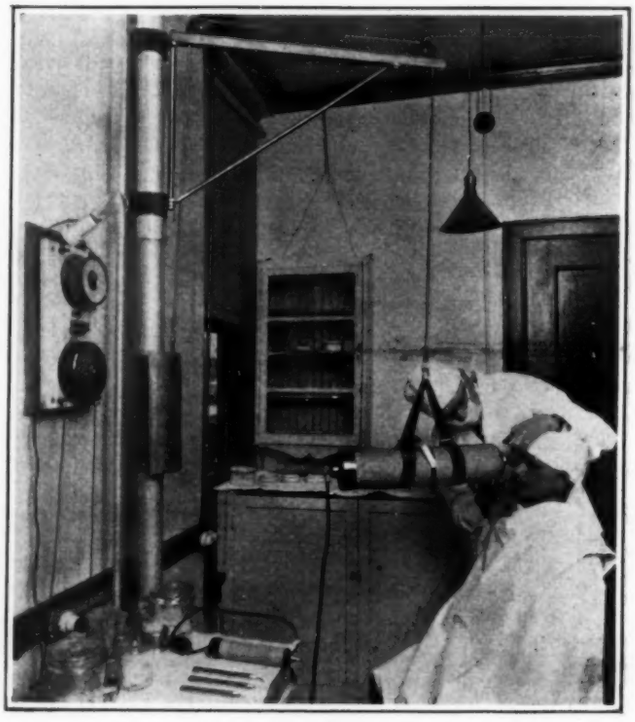


Fig. 3—Portable magnet suspended from crane gives great flexibility of manipulation

Another important factor in preventing eye accidents and conserving the worker's vision is improved illumination in shops. Much work is being done in machine shops to provide adequate illumination, of which Figs. 2 and 4 are good examples. The instructions drafted by the Illuminating Engineering Society of London, on conserving the workers' vision are worthy of consideration. Their instructions are as follows:

Fig. 4—Good illumination is a prime essential in a drafting room

Don't expose the eyes to shaded lights in the direct range of vision.

Don't work in a flickering light.

Don't judge illumination by brightness of the lamps.

Avoid excessive contrast.

Use the right type of globe, shade and reflector. Make sure the illumination is sufficient.

Keep lamps and reflectors clean.

Make sure the lamps are in the right position.

Direct light on the object, not in the eye.

The report of the Departmental Committee on Lighting in Factories and Work Shops, recently published in London, showed that by testing strength of illumination in a work shop on a well-lighted top floor it was found to be 2 to 10 per cent of direct sunshine. In one case the committee found that where an adequate lighting system had been installed, production had been increased by 10 per cent. Numerous surveys made in this country by lighting committees have shown the same startling facts.

Results of Recent Surveys

The British Journal of Ophthalmology reports that its recent survey showed that for many purposes an illumination of from 2 to 4 candlepower is sufficient. This Journal reports that for very fine work requiring great acuity of vision 100 candlepower is adequate, and beyond this intensity no further visual keeness could be found. An increase from 1 to 100 candlepower caused only a two-fold increase in visual acuity.

Psychologists tell us that blue lights are best for close work; red is preferred for distant objects, and ordinary white for all-around work. Our own experience has been that many obstinate inflammatory eye conditions among our employees actually improved while working under Cooper-Hewitt lights. There is a reason for this in that a green or blue light rests the eye.

One other factor that is receiving attention in industrial eye work and is worthy of mention here, as it is of interest to industrial managers, is that of the State Industrial Commission rating of impairment of vision of the injured worker. Forty-two states that now possess workmen's compensation acts are making an effort to agree on a fair adjustment of compensation for industrial eye injury involving partial or total loss of vision. Finally, it may be said that the prevention of industrial eye injuries has a good psychological influence on both employer and employee.

Welding in Mexico

By J. B. Green
President, Fusion Welding Corporation

I HAVE just returned from a vacation of several weeks spent in Mexico, and found much interest there in welding. I learned that welding rods, oxygen and acetylene are manufactured in Mexico, but nearly everything else is imported.

Nearly every large company has at least one arc welder, and there is some gas welding. Managers and engineers, for the most part Americans who have lived in Mexico for ten to twenty years, are keenly interested in extending the use of welding in their shops. For some reason, which I was unable to determine, they were not enthusiastic over any process except that of metallic arc welding.

For the most part, the men I met were directing very large enterprises. They possessed all the intelligence and business ability that men must have in similar positions in this country. They all directed their efforts toward impressing upon me the fact that Mexican metal making and using industries are not in such great need of welding equipment and supplies as trained welding engineers.

Few Americans have gone to Mexico to live during the last fifteen years, and so Mexican management had its American technical training before welding became so highly developed and universally practiced. It hears almost daily of the results obtained by welding in the United States and has no prejudice against purchasing welded articles, but almost completely lacks the trained men even to start to obtain similar results in Mexico. Working welders are not needed; plenty of Mexicans are available, at about half American wages, who quickly learn to handle an arc, and who can manipulate according to their instruction fully as skillfully as the best American operators. Men are wanted who understand what can be successfully arc welded and how, who know procedure control, and who know something about redesign for welding; in short, welding engineers. To such men, Mexican industry will pay higher salaries than apply in the United States. I suggest that men wishing to go to Mexico investigate the living conditions and climate as these are far different from those found in this country. Americans are welcomed by the people.

The application of welding in Mexico has not progressed very far. I have in mind particularly what we call "production welding." Some such welding is done in Mexico and more will be, but the country will never in this generation become a nation of manufacturers. The welding that is done is more a matter of repair and salvage with only a small amount of construction work. The opportunities for the welding engineer lie among the railroad shops, the tramways, the steel works and foundries, the oil refineries, the mines and smelters. There are some enormous enterprises of these kinds in Mexico with large amounts of invested capital. These companies are aggressively in the market for American welding engineers who will settle in the country. If successful, they will turn to the United States for much of the required welding equipment and supplies.

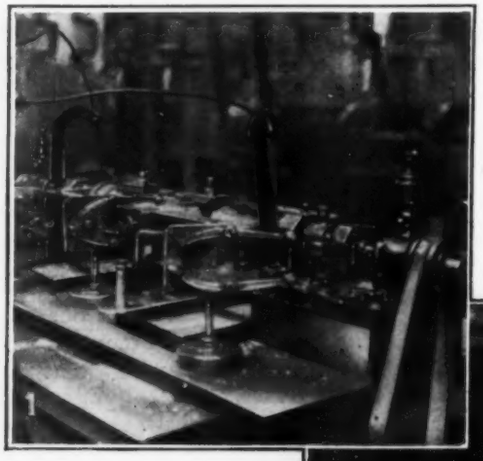


Fig. 1 — In centering the crankshaft, it is held in adjustable clamps so as to divide the material to insure plenty of stock for finishing. Ball-pointed indicators are used to show the amount of stock on each side of the center

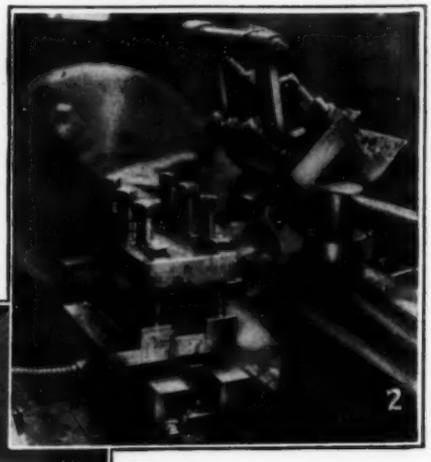


Fig. 2 — Turning the rear end bearing of the crankshaft. Multiple tools in both toolblocks divide the cut and speed up production. Facing is done by the tools in the swinging toolblock at the back

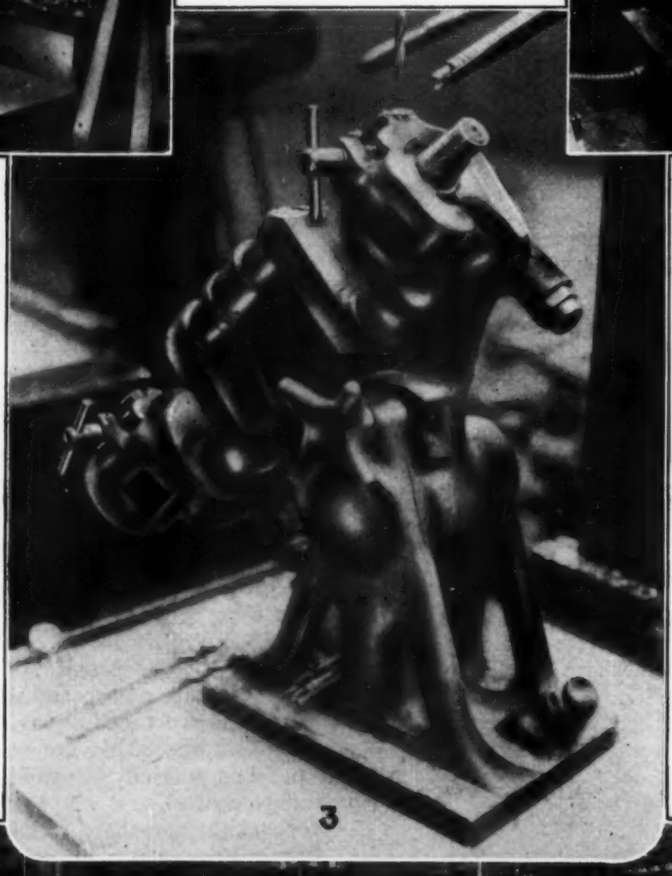


Fig. 3 — Drilling oil passage from front main bearing to the first crankpin. The shaft is held in a clamp at each end. Rotating the fixture brings the other end into position for drilling

Fig. 4 — Electroplating the crankshafts before casehardening so as to prevent hardening any portions except the crankpins and line bearings. The use of casehardened crankshafts is not common but is used in two motors in the United States

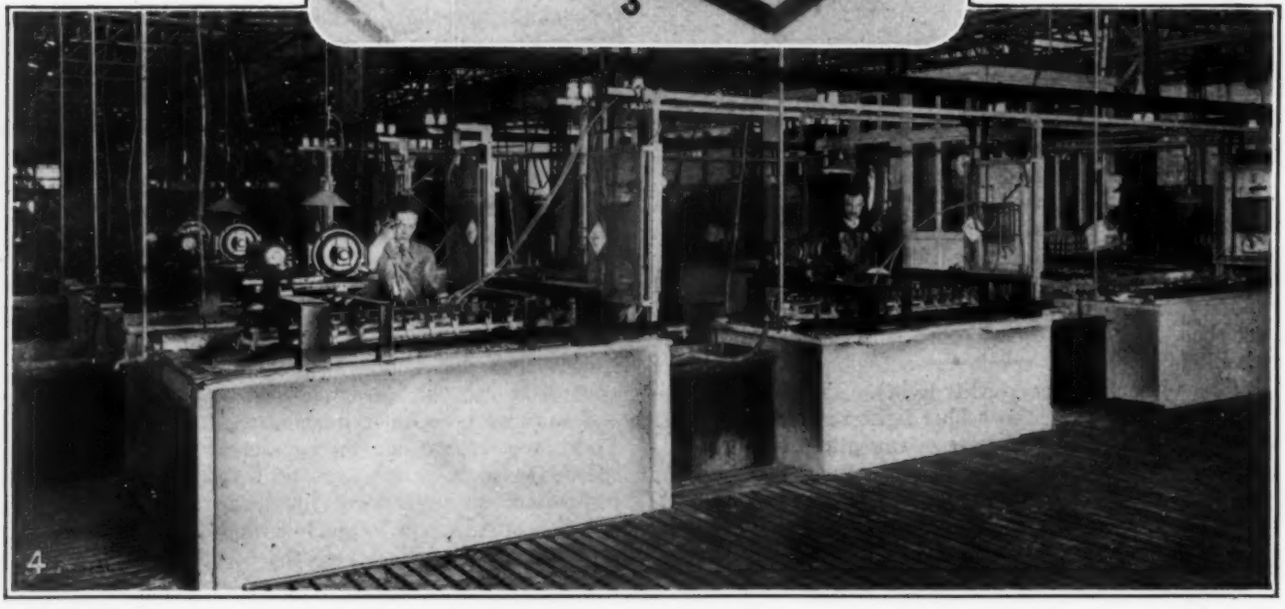
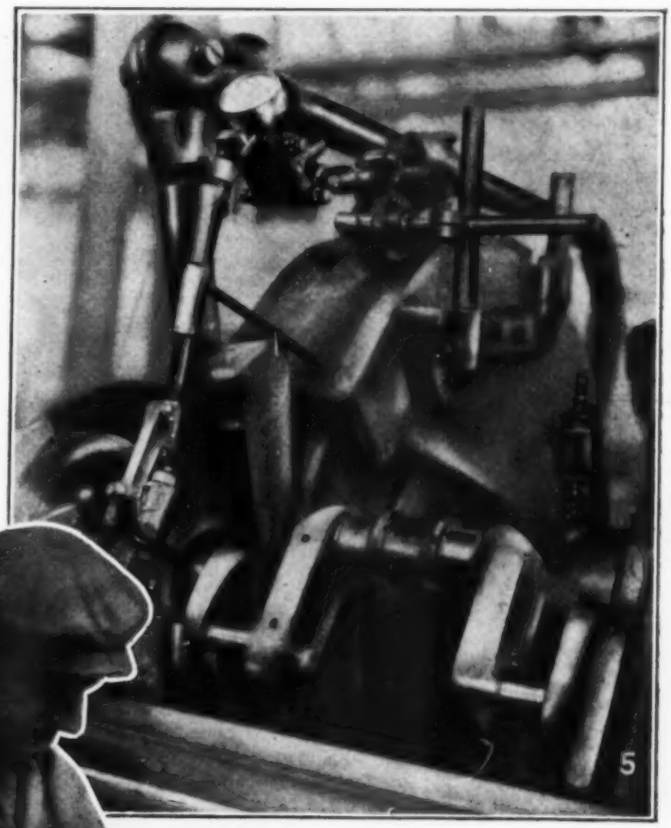


Fig. 5 — Grinding the end crankpins, using a gage that can be applied to the crankpin as it is being ground, and that shows the diameter at all times. The crankshaft is casehardened on the bearings only

How Citroen Handles Crankshaft Work



Photographs by courtesy of Andre Citroen Paris, France

Fig. 6—Polishing the crankshaft bearings. This work is done by the usual polishing clamps, using either very fine abrasive cloth or a fine powdered abrasive

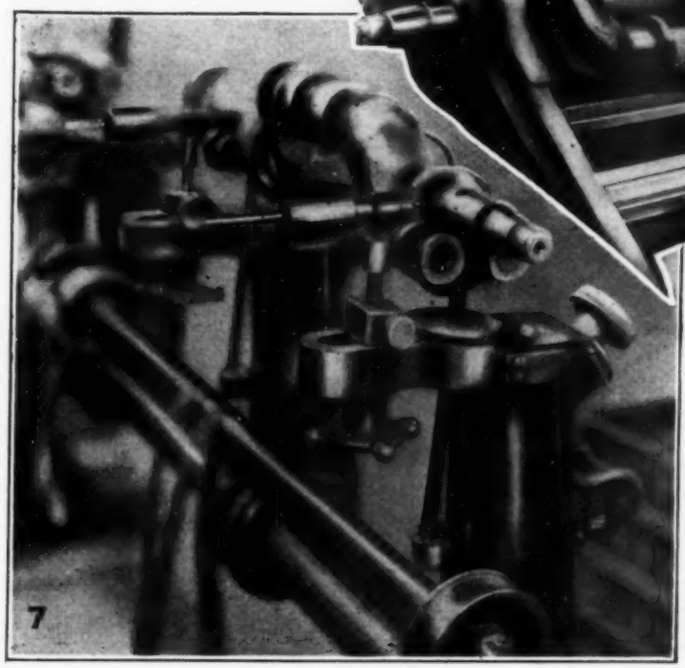


Fig. 7—The crankshaft is given a test for running balance on a Norton balancing machine. The shaft is supported on rollers at each end, the other end being driven by a belt

Testing Parts and Units in the Lancia Plant

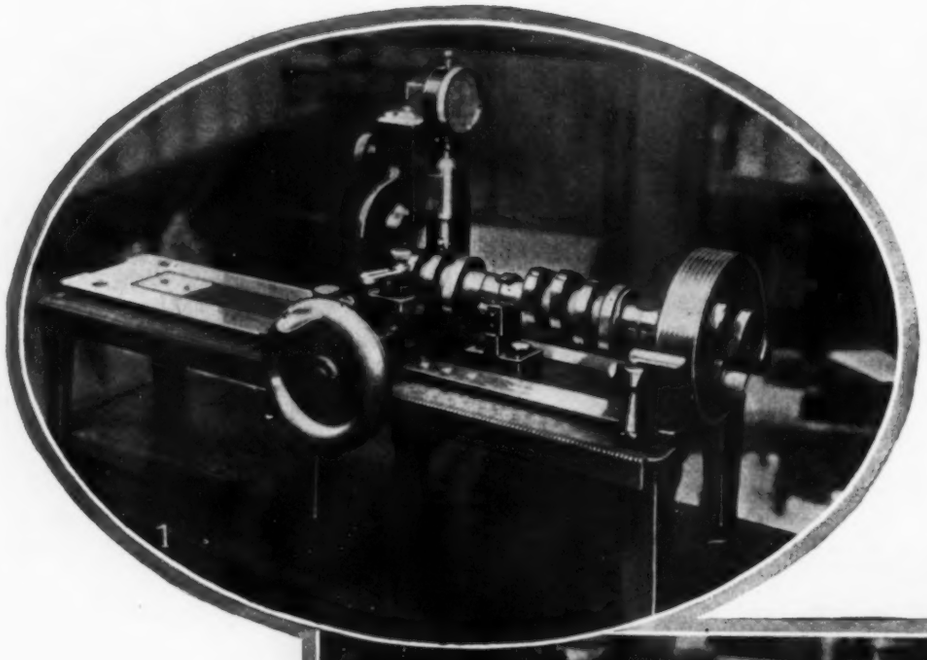


Fig. 1 — Inspecting camshaft of Lancia 4-cylinder engine. The test stand is fitted to test camshafts of any length. The large wheel at the right is graduated so as to check the cam lift at any portion of its revolution

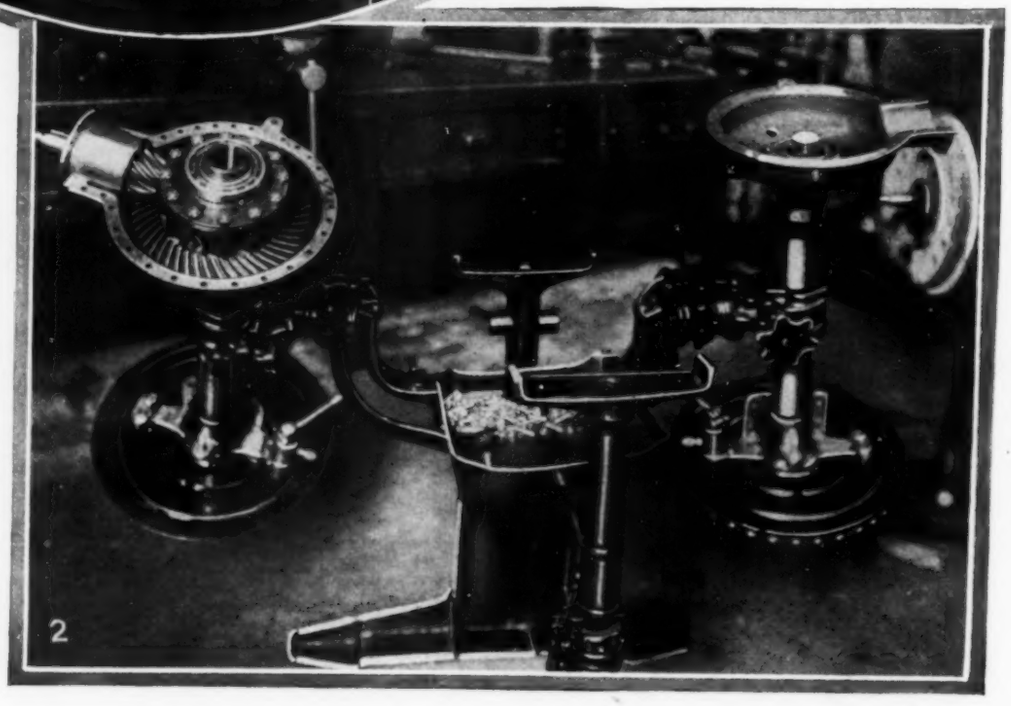


Fig. 2—Fixture for assembling differential gear units. One half of the housing is clamped in each end of the fixture and the gear, pinion and axle shafts are put in place. The two halves are then put together by swinging them on the ball joint that holds the clamp to the arm

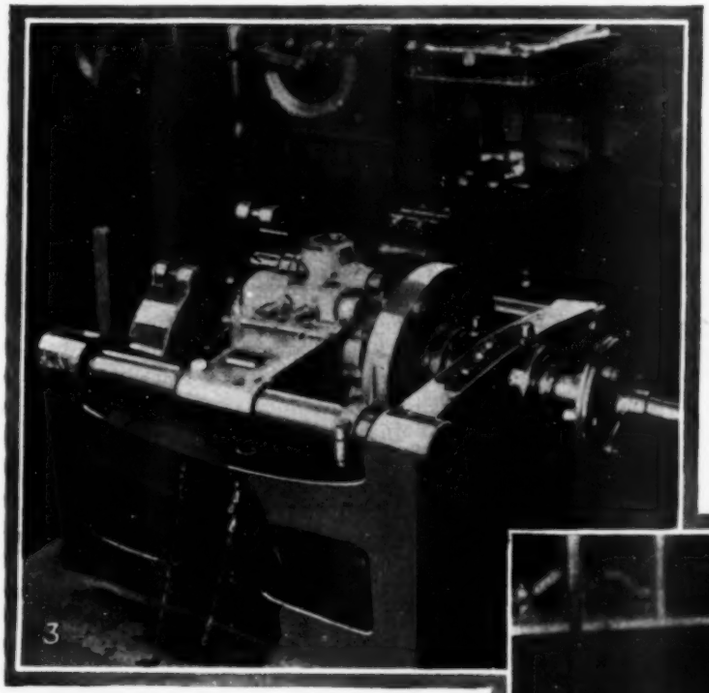


Fig. 3—Running-in a transmission unit before assembly in the car. The unit is driven by an electric motor. Load can be applied by a brake at the rear. When necessary, a fine lapping compound is applied to reduce any slight high spots and to give a very smooth surface. The testing is done in a "quiet" room

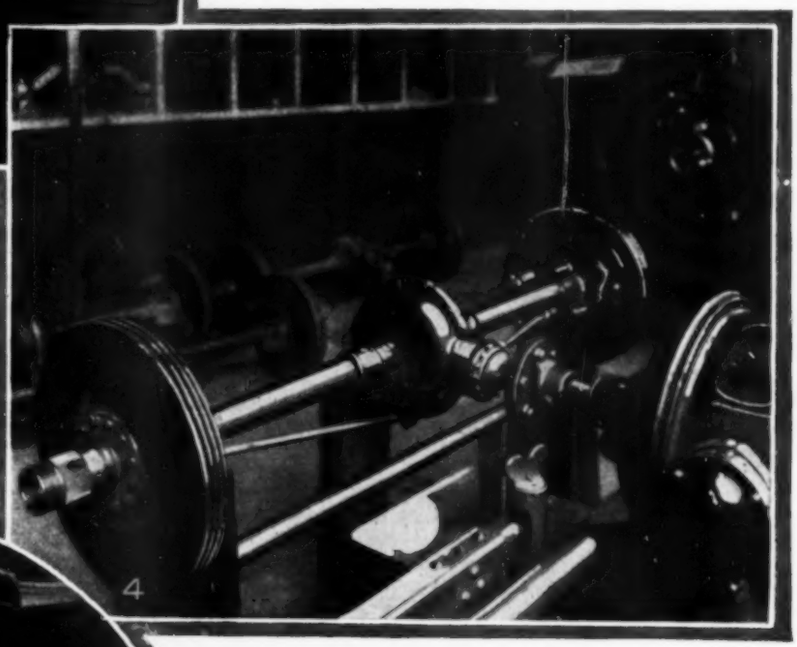


Fig. 4 — Running-in a rear axle assembly, using an electric motor on the test stand. Load is applied by the use of special brakes and, with the shop noises excluded from the test room, slight noises can be easily detected

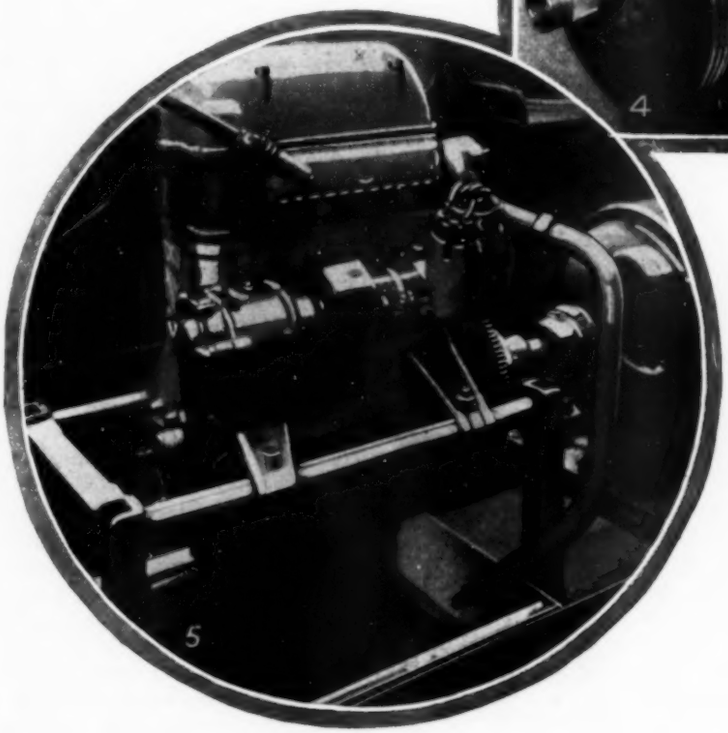


Fig. 5 — Running-in the complete engine. The engine is first run in by the electric motor, in order to get the working parts thoroughly lubricated before running it under its own power. This view shows the compactness of the Lancia engine, the short length being due to the staggered cylinders

MECHANICAL RESONANCE

One Cause of Gear Noise and Wear

By Anthony Bruce Cox

Torsional vibration of gears caused by fluctuations in length of load-carrying face results in extremely high loads when natural period is reached—Integral contact gears proposed

WHILE to some mechanics and engineers, a gear is just a gear, to others a gear is a machine element that deserves much study to perfect a design of gear, the teeth of which (1) when new shall not break out when the load applied; (2) shall not fatigue and break out after the gears have been in use for some little time; (3) shall not "pit" in operation; (4) shall not wear out quickly; (5) shall not cause excessive vibration and noise; and (6) shall have the proper theoretical shape to enable the gears to retain all their desirable properties during their useful life. After a gear has been designed, there comes the problem of manufacturing the gear to conform sufficiently close to the design specification so that it shall have the characteristics intended. The most important point is that in spite of all the older, as well as the more recent research in gearing, there is still much to be learned of the art of producing a commercially perfect gear.

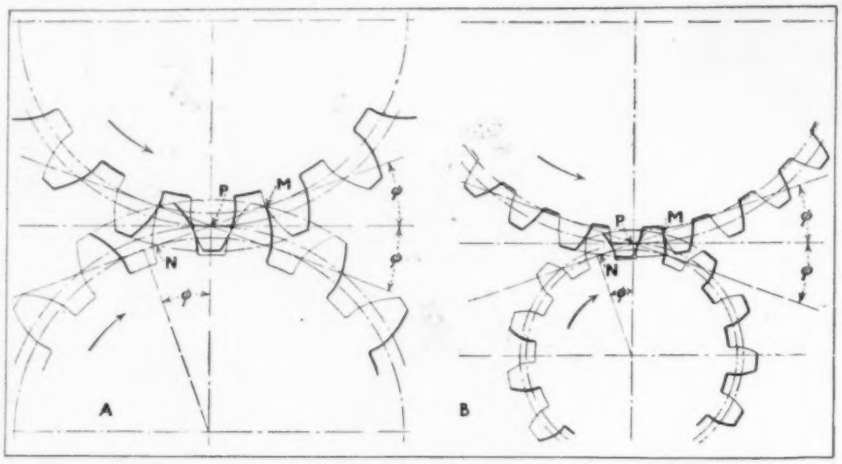


Fig. 1—Contact conditions for full depth tooth gears, A, and stub tooth gears, B. The teeth first make contact at M and as the gears rotate the contact moves along the line of action through the pitch point P and leaves contact at N. Angle φ is the pressure angle in both cases

As a part of the evidence to be introduced as showing that gears are not very well understood even by those who have most to do with them, the following paragraph is quoted from "Gear Teeth in Action," by Earle Buckingham, which appeared on page 586, Vol. 65, of the *American Machinist*. "It is well known that some high-speed gears have proved successful while others have not, though made with the same care and by the same concern. Sometimes gears show pitting on the tooth surfaces that cannot be explained by the amount of load transmitted. Furthermore, some of these drives are noisy at their operating speed. These unsatisfactory conditions seem to exist at times despite the care and attention given to the design and accuracy of the gear teeth."

Before any satisfactory explanation of this rather mysterious performance of gearing can be given, it is necessary to say something about the physical principles that underlie mechanical vibration, resonance, and noise. It is somewhat difficult to do this satisfactorily, because apparently there is no textbook that deals with these subjects in so complete and simple a way as to enable designers and mechanics to use them in the practical production of better gears. In spite of this handicap, it is still possible to gain some general ideas which will enable one to form fairly accurate judgments regarding gear vibration, noise, and resonance as they affect gear performance. There are two kinds of vibration that are important in gearing, and every piece of material has a "natural" period of vibration in each of these two kinds of vibration. The two kinds of vibration are linear, or transverse, and torsional vibration. The vibrating string of any stringed musical instrument is an example of linear vibration, and the vibration to and fro of the balance wheel of a watch is an example of torsional vibration.

Every string has a certain natural period of vibration. The strings of a violin have approximately the same length, but on account of their different weights and tensions, they vibrate at different frequencies. The same string may also vibrate more faintly at twice and three times its primary rate, thus giving rise to "overtones." If one speaks loudly near a piano, certain strings can be heard vibrating; the strings that take up the voice vibrations in this way have natural vibration frequencies which are approximately equal to those of the voice which caused the vibration. While the shaft of an ordinary gear is a rather thick "string," it actually does vibrate very much like a string, when it is rotated at, or near, the "critical" speed. Vibration is so serious at the critical speed that it is practically impossible to operate even a well-balanced shaft at a speed very near its critical speed. Automobile crankshafts and axles, Diesel engine crankshafts, steam turbine shafts, shafts of electric generators and motors, etc., are all designed so that their operating

speeds shall avoid this critical speed. For ordinary shafting this linear vibration critical speed is comparatively high.

The pendulum is usually given as the best example of torsional vibration, but since a pendulum is only one spoke of a complete wheel, and only makes a small part of one complete revolution, it is sometimes difficult to see the resemblance between a pendulum and a gear. However, a vibrating gear merely has this back and forth swing—like that of the balance wheel of a watch—superimposed on its complete rotations. Thus while the rotation of a gear is usually continuously in one direction only, the speed of rotation is continually and periodically slowing down and speeding up.

Torsional-vibration critical speeds in modern machinery are usually relatively much lower than the critical speeds of linear vibration. Some automobiles run "rough" at very slow speeds when the engine is operating at, or near, the torsional-vibration critical speed; and again run rough at some high speed, when the engine is operating at, or near, the linear-vibration critical speed. If the speed is still further increased until the critical speed is passed through by a considerable margin, the engine will again run smooth at all higher speeds attainable. However, if a high enough speed could be attained, a lesser degree of roughness in the engine running would be found at the "overtones" of the linear- and torsional-vibration critical speeds.

Gearing may be subject to one or both of these kinds of vibration. Since in most geared machines there are a number of different shafts each having its own natural period of vibration, it is difficult to avoid approaching some of these natural periods, and thereby causing trouble. In a gear, of course, the elastic bending of the teeth corresponds to the coiling and uncoiling of the hairspring of the balance wheel of the watch.

In a pair of ordinary gears, in which one gear is driving the other, almost always the load is successively carried by two pairs of teeth, then by one pair of teeth, then by two pairs again, then by one pair again, etc., as the gears rotate. In ordinary accurate involute gearing, contact between the teeth of meshing gears takes place only at points along the line of action. In a pair of gears, such as are shown diagrammatically in Fig. 1, the teeth first make contact at M, and as the gears rotate, the contact moves along the line of action, through the pitch point P, and leaves contact at N. If the number of pairs of teeth carrying the load (or tooth pressure) is plotted for a small part of one revolution, a harmonic curve like a, or b, Fig. 2, is obtained, the exact shape of the curve depending upon the details of the design. These curves correspond to the gears shown in Fig. 1. When two pairs of teeth are sharing the load, the teeth are deflected (or bent back) only slightly, but when only one pair of teeth is in contact, the teeth are deflected a great deal more, although not a large amount. Such action of the teeth of course results in a slight to and fro swinging, or vibration, of the gear in addition to its continuous forward rotation.

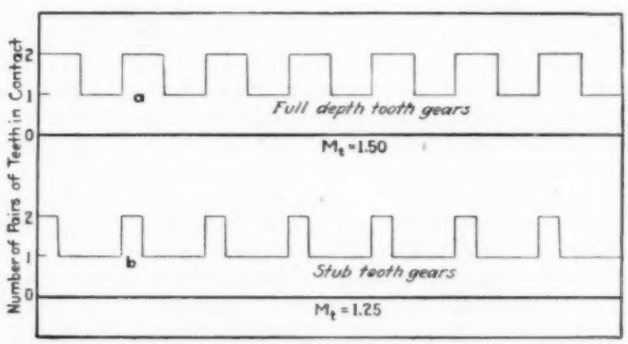


Fig. 2—Period of change in number of contacting teeth for full-depth and stub tooth gears

It has been found that if this vibration is near the natural period of torsional vibration of the gear, the vibration increases enormously and serious trouble results. Contrary to what seems to be the general belief, the speed of rotation need not be high to cause trouble; under certain ordinary conditions, it must be low in order to cause the worst trouble. The speed of rotation may be so low that the vibration is not audible; nevertheless this torsional vibration causes high instantaneous pressures between the mating gear teeth. This pressure is often high enough to cause pitting of the teeth; that is, pieces of the metal of the gears flake off from the contact surfaces of the teeth, leaving small pits or rough depressions on the teeth. The deflection of the teeth sometimes increases to such a degree that the metal "fatigues" and the teeth break out after the gears have been in use a short time. Of course, design calculations based on normal loads and reasonable overloads will fail to show the cause of this trouble. If the vibration is sufficiently rapid—from approximately 30 per sec. (or less) up to 30,000 per sec., or more, depending on the ear of the listener, additional trouble will be apparent as noise. As the period of vibration caused by the speed of rotation approaches the natural period of vibration of the gears, the noise increases astonishingly, and then if the critical period can be passed through, the noise decreases to a minimum again. Fig. 3 shows graphically how the amplitude of such noise, or vibration, increases and decreases again as the natural period of vibration is reached and passed through. For example, if the gears were rotating at a speed sufficient to give a vibration equal to one-half of the critical, the ratio of the impressed frequency to the reasonance, or natural, frequency would be 0.5 on the curve, and the amplitude of the vibration would be about 1.35. If the speed were increased until the impressed frequency were equal to the resonance frequency, the amplitude of the noise would be limited only by the amount of "damping" or deadening effect that might be caused by friction, etc. If the speed were still further increased until the impressed frequency were equal to 1.5 times the resonance frequency, the noise would be de-

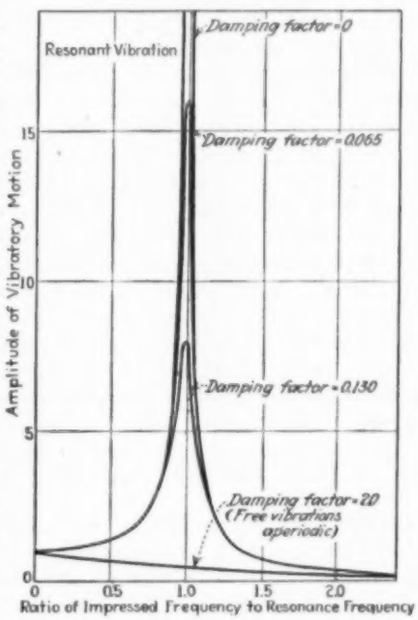


Fig. 3—Resonance effect with variable impressed frequencies and damping factors

creased to an amplitude of only 0.8 units on the chart.

In a set of steam-turbine, double-helical, speed-reduction gears used to drive a 300-kw. electric generator, the gears were as quiet as could reasonably be desired with no load on the generator, but as the generator load was gradually increased to about one-third load, the gear noise gradually increased to a degree almost unbearable to the ear, but as the load was still further increased, the noise gradually decreased until at full load and overload, the gears were again quiet. Every gear tester has noted this phenomenon. Of course, if the noise had been due to tooth errors, there would have been noise at all values of the load. While variation of the speed of rotation of gears is very likely to strike a critical speed, in the example just given, *the critical condition was obtained by a change of load only*, the speed remaining constant within about 2 per cent for the entire range of load. Apparently then the change of load affects the effective mass of the gear and thereby its polar moment of inertia, on which the critical period of torsional vibration depends.

Most instances of resonant gear noise are not as bad as the foregoing one. In many cases the noise is not bad enough to cause the gears to be absolutely scrapped, but only bad enough to keep them from being satisfactorily quiet. It is on such gears that the most time and money is expended in an effort to get them quiet enough to "ship."

In ordinary helical gears, the total length of tooth that is carrying the load, varies as in *A* or *B*, Fig. 4, as the gears rotate, the exact form of the variation curve depending on the details of the design. (See "Tooth Contact in Helical Gears," by Allan H. Candee, *American Machinist*, Vol. 62, page 457.) Curve *A* corresponds to what would ordinarily be found in automobile timing gears, and *B* corresponds to the wider face gears of general industrial application. It is perfectly obvious that such gears are very liable to resonant vibration, noise, fatigue, and pitting of the teeth, all at once, or singly, depending upon the design and conditions of operation. The absence of noise does not always mean that there are no excessive instantaneous high pressures built up by resonance to cause pitting of the teeth.

In a set of 2,600-hp. steel mill gears which were conservatively designed as regards strength and wear, and which were driven by an induction motor, the teeth pitted badly and finally fatigued and broke out after only a few months' use. An induction motor, as is well known, is like an automobile engine; it will "die" if overloaded beyond a certain value of the load (usually two or three times full load). These gears were calculated for this "pull-out" torque value, and every precaution was used in their manufacture.

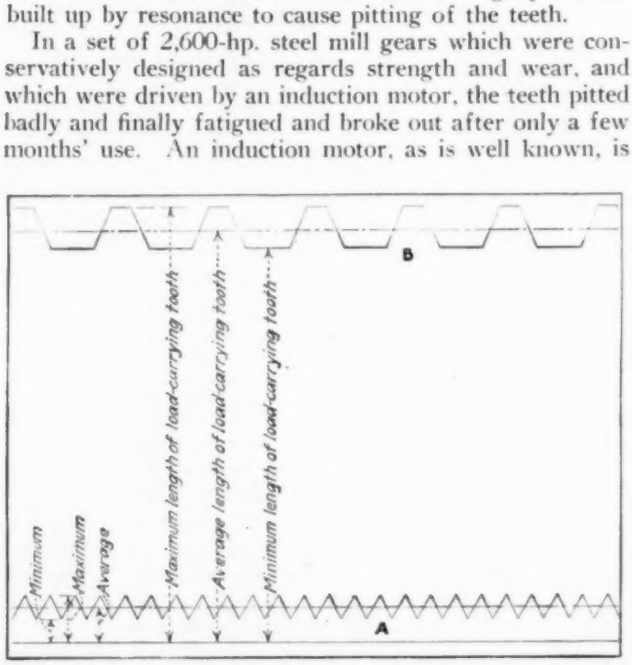


Fig. 4—Variation of the total length of load-carrying tooth in helical gears of narrow face, A, and, B, wide face

Referring again to Fig. 1, it is seen that the leading pair of teeth in the contact zone is about to leave contact. When two pairs of teeth are in contact, the total load transmission pressure is divided between the two pairs of teeth, but when the leading pair of teeth leave contact, the total pressure of the load is thrown on the next following pair of teeth in the contact zone *M-N*. This latter tooth pair has to carry the total transmission pressure alone until the next following pair of teeth come into contact, thereby again halving the pressure on each pair of teeth in the contact zone, and so on, over and over, as the gears rotate. Now it is known that the wear on gear teeth increases very rapidly with increase of pressure, particularly for pressures beyond a certain value which is critical for each class of material. If then, as is often the case in heavily loaded gears, the total transmission pressure happens to come much above the critical wear pressure, a "hole" will be worn in each tooth in the contour near the pitch line on that part of the involute curve that has to carry the total transmission pressure momentarily during the contact period of each tooth. This typical wear occurs so frequently that it has been given the name, "ridging." Fig. 5 shows such a typical wear curve, which incidentally, was drawn from actual measurements of a large number of worn gears that had been in commercial use. (See also wear curves of Professors Ham and Huckert, University of Illinois Bulletin No. 149.)

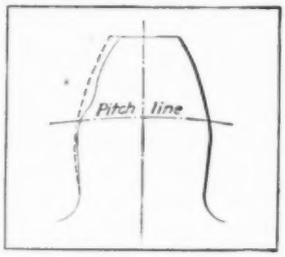


Fig. 5—Typical wear of standard spur tooth showing "ridging" effect near pitch line

Of course such gears become excessively noisy as the teeth wear out of shape in this manner, and no amount of original accuracy in cutting and aligning the gears will prevent it. If ordinary gears are to avoid this sort of wear, they must be designed for very light wear even when one tooth is carrying the total transmission pressure. This is of course expensive and wasteful designing. On account of fatigue and pitting failures from these hitherto unknown causes, designers have been very cautious in their calculations for all gears, both spur and helical of all types. In general, all gears are loaded much below what they might safely carry if properly designed.

In "An Investigation of the Efficiency and Durability of Spur Gears," University of Illinois Engineering Experiment Station Bulletin No. 149, July 20, 1925, Prof. C. W. Ham and J. W. Huckert say, "Apparently for any pair of gears there is a critical surface pressure, governed by the properties of the materials, above which the life of the gears is short and below which the gears will run indefinitely without appreciable wear."

In "The Relation of Load to Wear on Gear Teeth," *American Machinist*, page 777, Vol. 64, Prof. Earle Buckingham says, "In many cases, wear on gear teeth becomes apparent first at, or near, the pitch line. Why this is so is still somewhat of a mystery. Possibly one contributing cause is the fact that at the pitch point, one tooth is usually carrying the entire load while at the top and bottom of the active profile, two teeth are engaged."

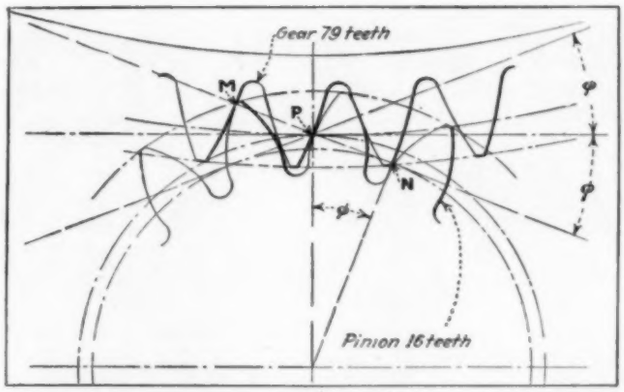


Fig. 6—Extreme design of integral contact gears made to replace some noisy, short-lived gears without changing existing center distances

In the American Gear Manufacturer's Association, "Suggested Standards for Future Design of Bevel and Spiral Bevel Gears," approved Oct. 11, 1922, there is a paragraph which reads as follows: "But it is well known that the greatest wear often takes place near the pitch point where there is no sliding action. This is because the big factor causing wear is unit pressure and not sliding action. When the point of contact is near the pitch point, all the load is borne by one tooth, while it is distributed over two teeth near the beginning or end of the action with a consequent reduction of unit pressure."

The phenomenon of mechanical resonance is similar in principle to that of electrical resonance in radio reception. To tune in a radio receiver, we adjust our receiving set until it has a natural vibration period which is as nearly as possible equal to the frequency of the broadcasting station wave. The sound given out by the receiver increases enormously as the natural vibration period approaches that of the sending wave; that is, as we turn the tuning dial. Similarly, we have just seen how the vibration and sound given out by a set of operating gears increases greatly as its natural period of vibration is approached by operating conditions. Now, if the radio station should try to broadcast its program by using direct-current electricity, it is obvious we could not tune our receiving set because there would be absolutely no period of vibration to tune to. So also in gearing, if we can design our gears so that they will not have any harmonic variation of the total length of load-carrying tooth as the gears operate (see Figs. 2 and 4) there can be no *mechanical* resonance.

In spur gears, a constant total length of load-carrying tooth is obtained by designing the gears so that just as one pair of teeth is leaving contact, another pair is coming into contact. This integral contact design, in gears that are otherwise properly made, effectually prevents harmonic variation of the total length of load-carrying tooth with its accompanying vibration, noise, tooth pitting, fatigue, and tooth contour destruction.

Practical design considerations usually call for rather small numbers of teeth in the pinion. In order to secure this feature, it is usual to use no more than two pairs of teeth in contact in the plane of rotation of the gears, although with larger numbers of teeth, three or even four or more pairs of teeth in contact *can* be used. Two examples of gears having two pairs of teeth continuously in contact in the plane of rotation are shown in Figs. 6 and 7. Fig. 6 is an extreme design made to replace some noisy, short-lived gears without changing existing center distances or other operating requirements. [For additional proof of the strength of pointed and semi-pointed teeth, see Society of Automobile Engineers *Journal*, page 134, Vol. 20, for January, 1927, "Timing Gear Development," by R. S. Drummond.]

A set of interurban-railway gears having integral tooth contact, as shown in Fig. 7, has now run in actual service more than one million car-miles, and the gears still look and perform like new. Similar gears, but without integral contact, have not lasted nearly as long.

Besides being noiseless and long-lived, integral contact gears are capable of carrying loads that are enormous as compared to the loads that ordinary gears can carry. In the *Zeitschrift des Vereines Deutscher Ingenieure* for October, 1926, in an article entitled "Dynamischer Ausgleich von Zahnrädergetrieben" (Dynamic Compensation of Gear Drives), H. Hofer describes some tests made in Germany on a set of integral contact gears. These gears are approximately 8½ diametral pitch (3π mm.) have 27 teeth in each gear (about 3.19 in. pitch diameter), and in October, 1927, had been running for 3½ months at a speed of 1,500 r.p.m., and a load of 1,680 lb. per inch of face without any appreciable basic wear. Mr. Hofer states that not only did the teeth of these gears *not* wear out of shape, but what little wear there was tended to bring the teeth down to the correct contour; that is, the teeth were self-correcting. Reference to Figs. 6 and 7 will show the reason for this.

In helical gears, a constant total length of load-carrying tooth can be secured either by making the contact

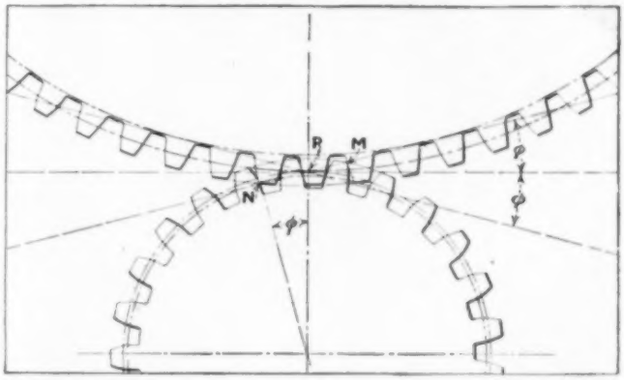


Fig. 7—Contact conditions of a set of interurban-railway gears having integral tooth contact. This set has been in actual service for over one million car-miles

in the plane of rotation integral as in non-resonant spur gear design, or by making the width of face of the gears equal to a multiple of the axial pitch, or preferably by both methods simultaneously. One large manufacturer of geared turbines has standardized integral contact gears for all steam turbine speed reduction units, and has built many thousand horsepower of the gear with uniform success. Manufacturers in the same and other fields are beginning to apply these gears to their difficult drives, and the gears are being tried out in automobiles.

There are a number of ways of standardizing integral contact gears for commercial production, with or without the purchase of additional cutters, even for a factory of diversified product. Since integral contact gear designs offer such large savings in longer life of the gears and greater horsepower transmitted; or conversely, in smaller gears of cheaper materials; and since the gears are quiet in operation and *stay* quiet, the introduction of integral contact gears should foreshadow the early extinction of the ordinary gear set.

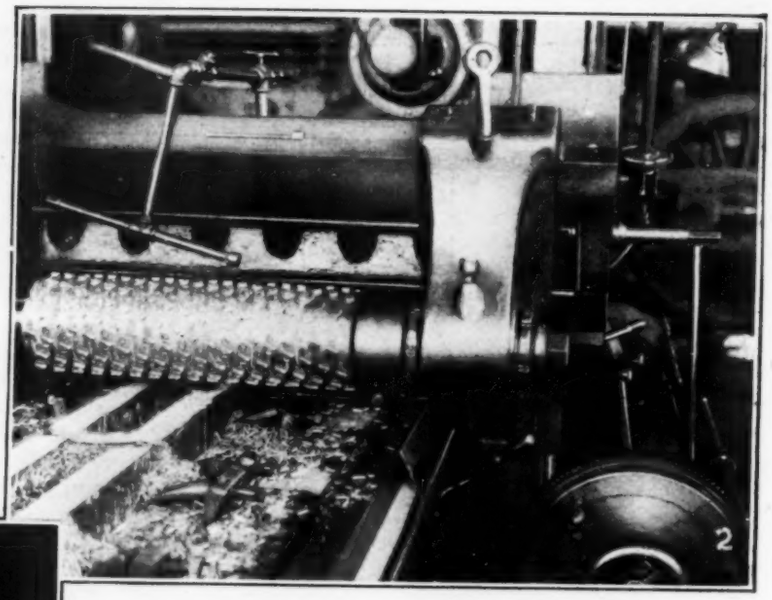
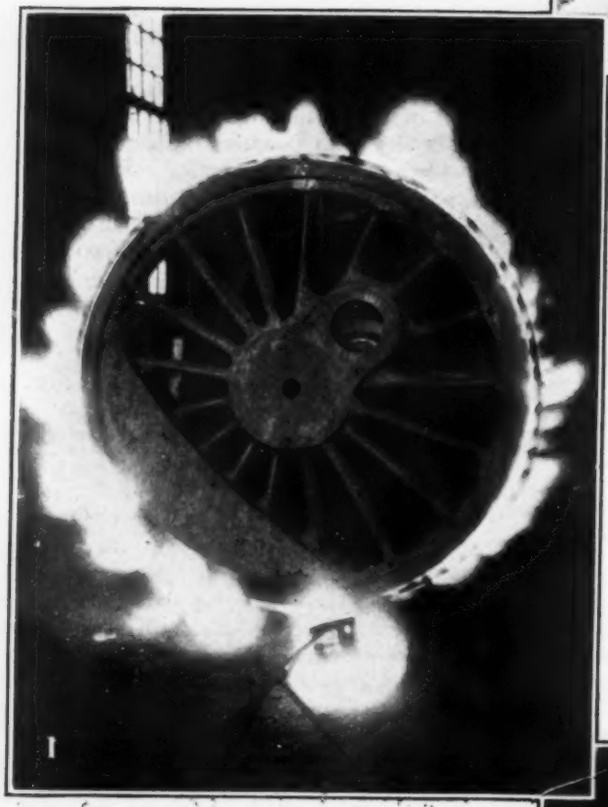


Fig. 2—Milling rod-end straps on a planer-type milling machine. Any number of straps within the capacity of the machine may be set up on the table and milled at one pass



Miscellaneous Jobs in a Railroad Shop

Fig. 1—Removing a worn tire from a driving wheel. A ring of ¾-in. pipe having small holes on the inner side is slipped over the tire. Kerosene, vaporized by air pressure, is blown into the ring, to issue from the small holes as jets of flame impinging upon the tire. From seven to fifteen minutes are required to heat a tire sufficiently to loosen it from the wheel center

Fig. 3—Milling the contour of a rod-end. The rod is mounted upon a stud centered on the machine table. Blocking near the edge of the table helps to support the weight of the rod. The over-hanging end is suspended from a jib crane. The cutter is fed into the work until it is tangent to the arc to be milled, when the rotary feed of the machine is engaged

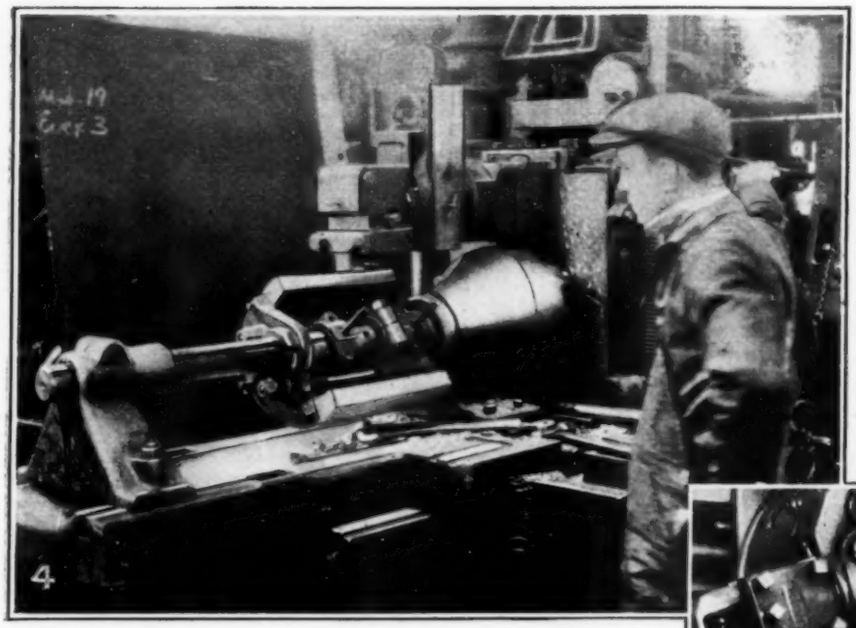
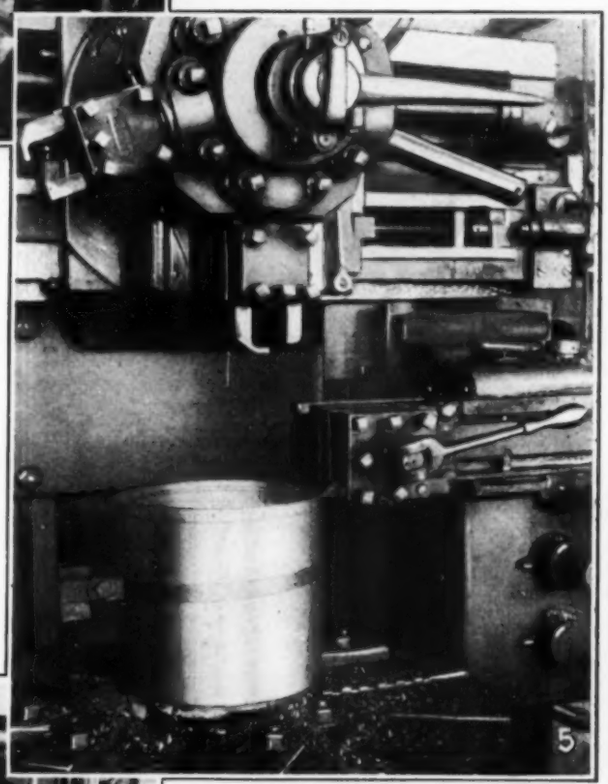


Fig. 4 — Planing the circular contour of a crown brass in a draw-cut shaper. The brass is held on the mandrel by end pressure imposed by the set-screws in the moveable flange. The extra length of the mandrel and the adjustability of the flange provide capacity for brasses of any length

Fig. 5—Making piston rings. The rough-bored and turned pot casting is split so as to remove the right amount of metal to allow the rings to close to cylinder diameter. The split shell, closed by clamping rings, is centered upon the table of a boring mill. The tools in the turret finish-bore and turn the shell for a distance equal to the width of one ring, which is then parted off by the tool in the side head



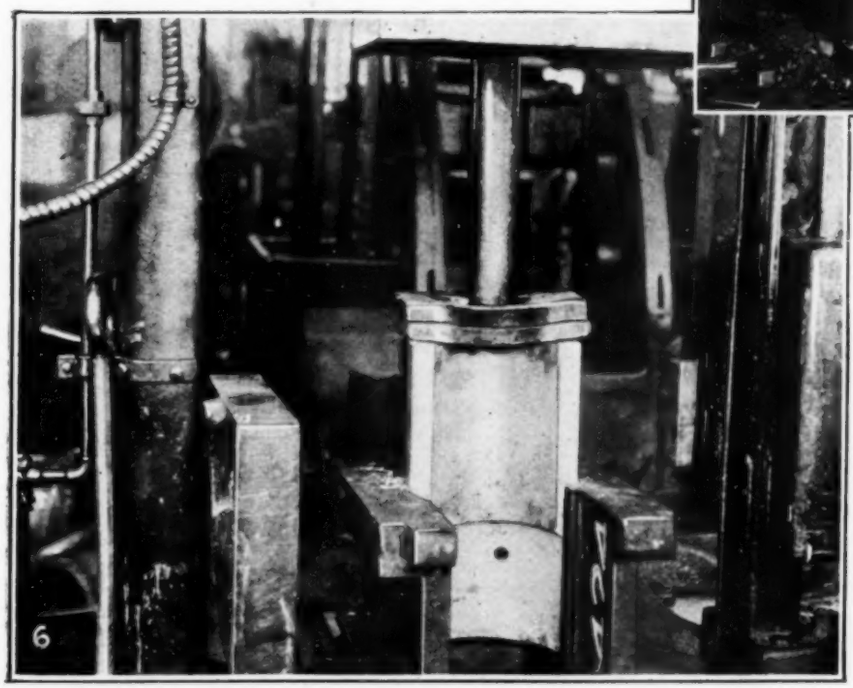


Fig. 6 — The crown brass, having been machined to fit its individual driving box, is forced into place under a hydraulic press. The inner face of the box is slushed with a compound of white lead and oil to act as a lubricant. A pressure of several tons is required

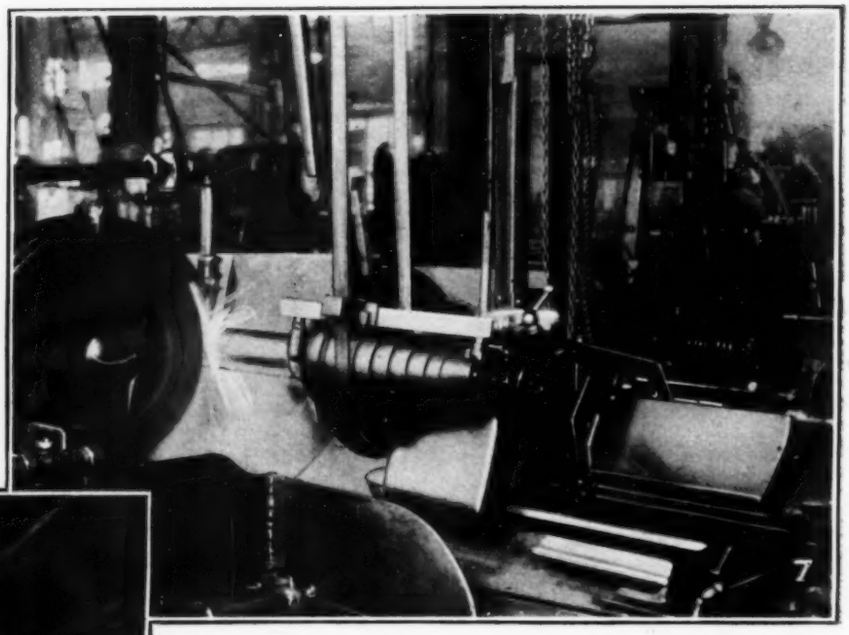


Fig. 7 — Piston rods, valve rods and similar parts are finished to size on a cylindrical grinding machine. While this machine cannot be expected to compete with a lathe in removing a large amount of stock, as in turning a new rod, it is capable of making the final cut in a fraction of the time and of leaving a far superior finish

Fig. 8—These tongs enable the crane to pick up a driving axle with ease and safety. There is no need for the "hitcher" to hunt up a chain sling, bar the axle from the floor in order to pass the chain under it, and then to wonder if his improvised slip-noose is going to convey the axle safely or allow it to slip endwise out of the sling at a critical moment

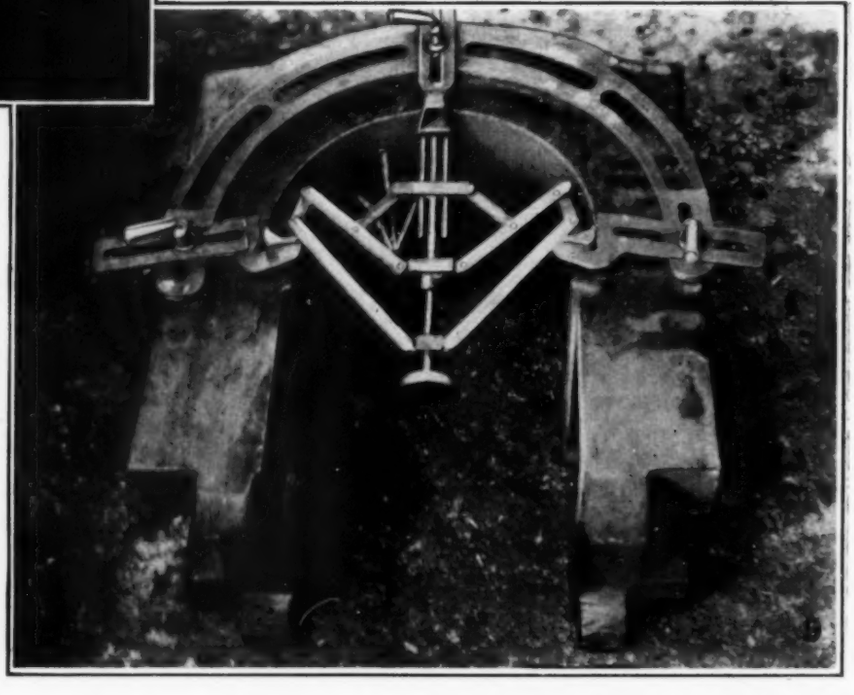


Fig. 9—This tool is for laying out a crown brass for the purpose of fitting it to a driving box. The outer part of the tool is adjusted to the planed inner surface of the driving box and the inner part is adjusted to match it. The inner part is then transferred to the chalked end of the crown brass and from it the working lines are scribed upon the brass

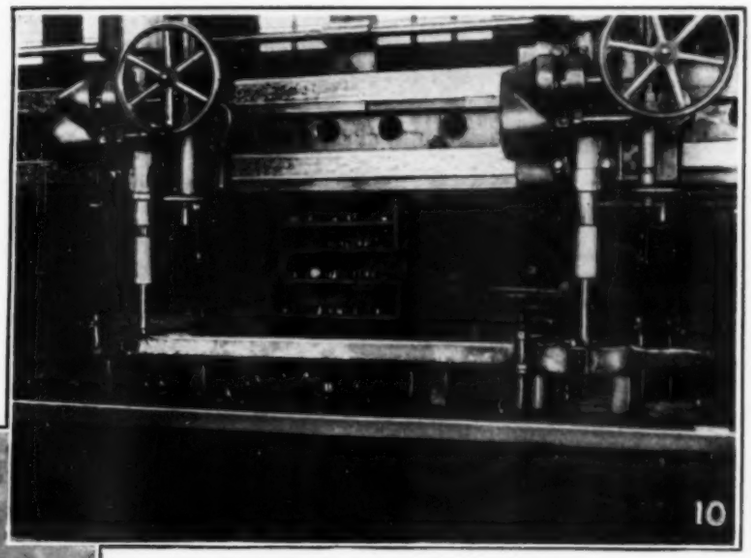


Fig. 10—Boring holes in both ends of a side rod at once. The adjustability of the heads along the rail allows the machine to accommodate rods of any length within its capacity. On new rods the holes are trepanned before starting the boring cuts. Trepanning is preliminary to boring all holes above 6 in. in diameter

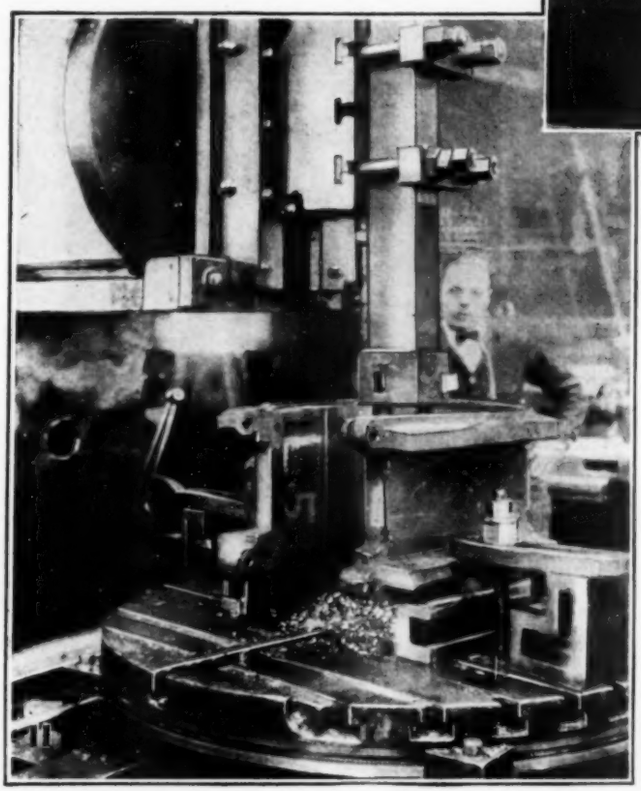


Fig. 11—Machining the inside of a driving box for the crown brass. The rotary movement of the machine table permits the box to be planed inside to a true radius, while the angular ledges at each end of the arc can be machined at the same setting by means of the cross and traverse movements without disturbing the tool in its holder

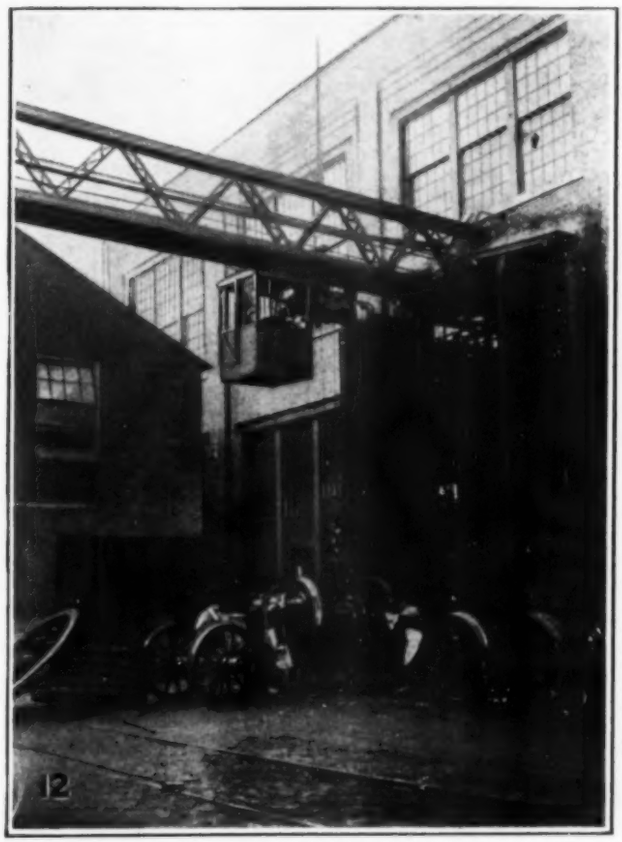


Fig. 12—This crane goes out of doors. On one of the smaller of the bridge cranes that serve the erecting shop, a trolley runs upon a suspended rail instead of above the bridge. A load may be picked up and the crane run to a position opposite to the end of the fixed bridge to be seen in this picture. The trolley with its load can then be run out upon the fixed bridge. A locking device prevents the traveling bridge inside the shop from being moved until the trolley returns to it

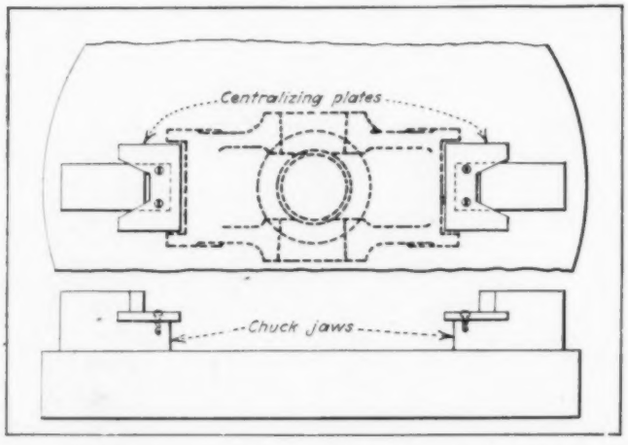
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Chucking Plates Aid in Setting Up Crossheads

By George H. Feltner

As a rule, the chuckng of crossheads in a vertical boring mill for the refinishing of the taper hole for the piston rod is a difficult job unless some sort of a fixture is used. The hole must be central, otherwise undue wear will result on the guides and shoes. In the illustration



Locating a crosshead for machining the taper hole

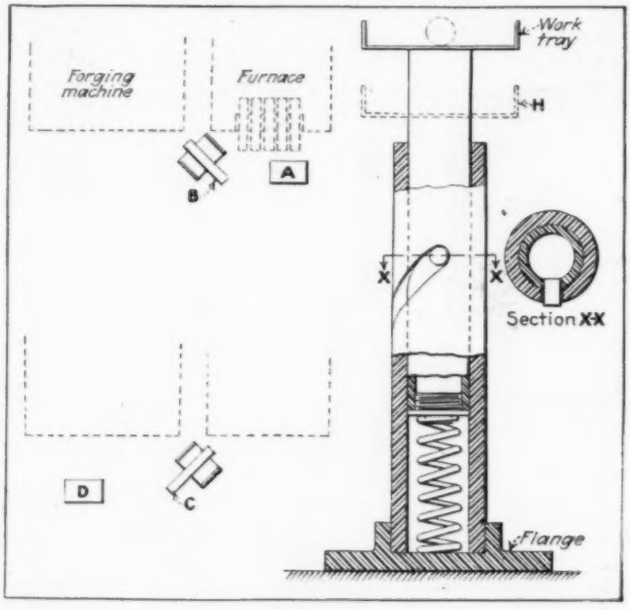
is shown the method of locating the work in a Southern shop, which is somewhat simple in nature, yet accurate in its purpose. Two of the four jaws of the boring-mill chuck are equipped with centralizing plates that align the work from the previously machine guide fits. The work then is held down by strap clamps and is machined in the usual manner. By making the plates interchangeable, crossheads of different sizes can be accommodated.

A Device for the Forge Shop

By D. V. Thompson

Much of the inconvenience usually experienced in transferring heated work from a furnace to a forging machine, or hammer, is eliminated by use of the turning device illustrated. In brief, the device automatically turns the work 90 deg. after the furnace operator standing at *A* has placed it on the tray as at *B*. This movement brings the work into the position shown at *C*, so that the operator of the forging machine at *D* can reach it conveniently.

The outer housing and the plunger, or tray support, are pipe sections and are a slip fit. A helical spring of



Device for automatically changing the position of work

sufficient tension holds the plunger at the upper position when the tray is empty, but as soon as a piece of work is placed on the tray, the plunger descends. A pin fastened to the plunger engages a helical groove in the outer housing and causes the plunger to turn as the tray descends to the position shown by the dotted lines *H*. The device is easily constructed and can be applied to various types of installations.

A Stencil That Cuts Hours to Minutes

By M. E. Beckstrom

Use of silk stencils, such as the one illustrated, has created large savings in lettering car parts at the North Little Rock, Ark., shops of the Missouri Pacific Railroad Company. In stenciling the sign "Passengers Must Keep Off the Platform" on car doors, the time has been reduced over that required for hand work from approximately 3 hr. to 5 minutes.

The frame of the stencil, made of wood, is beveled around the outer edge to form a surface on which to tack the silk. The silk, known as Bodemer bolting cloth, is stretched tightly on the back of the frame, so that the mesh will be even in both directions. The contacting side of the silk is then given a coat of thin glue, after which it is painted around the lettering on the inside. The paint is made of equal parts of oil color and japan, to which is mixed turpentine to suit. When thoroughly

Stenciling a passenger-car door

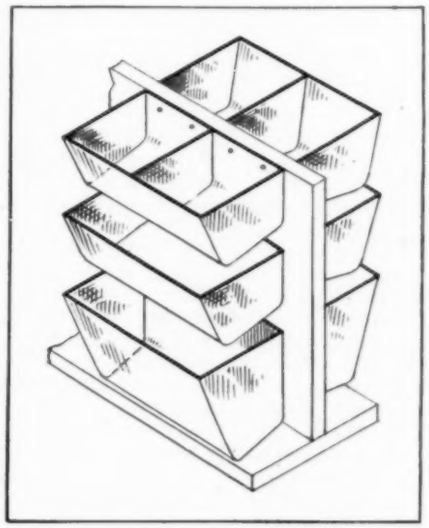
dry, the stencil is ready for use. A small amount of lacquer is put on the inside of the stencil and when the stencil is applied to the door, the lacquer is spread over the lettering by a squeegee. A certain amount of lacquer is thus forced through the unpainted meshes of the silk and is transferred to the door. The stencil is then removed and gold leaf is applied to the letters lacquered on the door. After the lacquer has dried, the gold leaf is wiped gently, removing the loose particles surrounding the lettering. The letters are then protected by a coat of varnish.

Combined Bins and Racks for a Small Shop—*Discussion*

By Charles F. Henry

The bins and racks described by Henry C. Francis in an article under the title given above, on page 745, Vol. 68, of the *American Machinist*, should prove convenient in many small shops. May I suggest a design for bins that have been found useful in the shops of some of my friends.

The bins, as shown in the illustration, are made of sheet steel, in convenient sizes, and can be fastened to the wall or partition, or on both sides of a vertical upright having a substantial base. By making the fronts of the bins slope outward, there is plenty of room to reach into the bins beneath. It will also be noted that the bottoms of the bins slope forward, so that material slides forward where it can be easily seen and reached. As a method of storing bolts, pins, short rods and semi-finished parts, these bins have many points in their favor. They are compact, keep things together and off the floor, and have much to commend them.



Convenient bins for small parts

A Preheating Chamber for a Cyanide Furnace

By Milton Wright

Anyone experienced in heating steel for hardening by immersing it in molten salts or lead, fully recognizes the necessity for having the work absolutely dry when it goes into the heating bath. Even a small amount of moisture can cause an explosion that may result disastrously to the operator. In the illustration herewith may be seen a preheating chamber attached to the side of a cyanide furnace in the hardening room of the Hartford Machine Screw Company, where many products are case-hardened by the cyanide process.

The work is handled in wire baskets, several of which may be seen on top of the chamber. Each time a basket of work is removed from the cyanide to be quenched, a basket of preheated work is taken from the lower shelf

Preheating chamber for a cyanide furnace

of the chamber to replace it in the cyanide, a basket of partly heated work is transferred from the upper to the lower shelf of the chamber, and a newly-filled basket is put on the upper shelf. Thus there is a continuous succession of work passing through the process all the time.

The chamber is made of sheet metal and light angle iron to inclose three sides, the fourth side being the wall of the furnace itself. A rectangular opening in this wall directly below the lower shelf allows a considerable amount of the heat to escape into the chamber, where it is confined by the side walls and the hood in such manner as to be directed upon and around the baskets of work on the shelves.

As the work comes to the heardening room from the washing machines, there is just a possibility that it may be sufficiently damp to cause trouble if placed directly in the heating bath, but after a few minutes on the upper shelf there can be no question of its dryness. On the lower shelf the temperature is raised still further, so that when a basket of work is finally immersed in the cyanide it causes no disturbance of the molten salt.

· TECHNICAL · ABSTRACTS ·

Decimal System Not Metric

Many advocates of the metric system are confusing it with the Decimal System. Because a certain measure is expressed in decimals, it does not mean that it is a metric measure, although many people think so, and pro-metric advocates deliberately foster this mistake. So what merit there is in the system, is not in the unit, but in the decimal system applied to it. The decimal system did not require a change of unit, and could have been applied just as well to the existing foot unit, and to better advantage than to have adopted a new arbitrary unit to replace the one so universally used, which was the development of many generations and, therefore, a vital part of the language and literature.

The metric unit was intended to be a scientifically accurate unit, equal to the ten-millionth part of the terrestrial quadrant. It was supposed that such was the case, as French engineers had spent seven years in determining the exact kilometre. But after being in use a number of years, it was discovered that the distance taken as the basis of a metre was inaccurately measured. It was then too late to correct it, so that the metre as a unit is just as arbitrary as the foot.—W. L. Austin, *Weight and Measure*, May.

Best Machinery Results in Large Savings

A study of over-production and obsolescence in equipment indicates some interesting possibilities. There is no doubt that the existence of obsolete machinery at the present time constitutes a great portion of any over-capacity. Such machinery, however, can be operated only on a marginal basis and is capable of profitable performance only when shortage of goods brings higher price levels.

Balanced production and consumption through the interchange of goods is very possible, particularly with the close check maintained by modern business on this interchange. But balancing the load which is placed on labor for a given production in one plant with that of another is impossible so long as equipment is out of balance. It is very possible that with late machinery we might come very soon to a standard six-hour day and a five-day week providing the demand for products permitted this. But the prevalence of obsolete equipment interferes seriously.

Modern machinery is bound to work out its own salvation; for modern machinery controls the factors of flow of materials, and consequently, in the nature of progress, it pays its own fare plus a profit. The faster flow of materials with modern machinery means a faster turnover of working capital. From the raw material to the finished product it means less in inventory, a shorter time in process as well as a lower cost and the release of this frozen capital during the years since the war has furnished generous funds which tend toward cheaper money. The lower money rates are making it possible for the manufacturer to invest in more of modern equipment and the healthy competition under the balanced conditions of more modern plants will net profits yet reduce profits to a point that will eliminate any competition from obsolescence.

Passing to the question of unemployment, the production machine which has required less labor per unit of production and has turned out additional quantity has also reduced costs and prices with a much wider spread in distribution of its product. The labor released has already been partly absorbed in distribution. It has also, in many lines, released workers from hand labor to be re-absorbed in the supervision of production machines that have followed later to fill the greater demand for goods. Even in the automotive field, aside from the direct use of labor reabsorbed in the production of the product, there has been built up an accessory and a service station business which absorbs these men released from direct production in the maintenance of such a mechanical product.

With intelligence gaining and the natural human desire for better conditions, it is a question whether the shorter work period will not release greater spending capacity and therefore cause greater production demand. It would seem reasonable with balanced production and consumption on the basis of this shorter period, to expect a more highly developed individual who will have more time and require more diversion. This may mean an increased consumption of goods, it may mean a scattering from the crowded centers of manufacturing and production to smaller industrial communities.—E. P. Blanchard, *The Financial Digest*, April.

Bakelite Bonded Wheels

No one will deny that it pays to test various grinding wheels from time to time with the object of reducing production costs, for the wheel that is efficient today maybe far outclassed tomorrow. For example, the general introduction of the synthetic resinous bond, derived from phenol and formaldehyde and sold under the general trade name of bakelite, is changing grinding conditions in many plants. These wheels are used on operations where the shellac-bonded wheel was formerly employed, and lately they have been employed successfully in competition with vitrified wheels for such rough work as snagging castings.—*Abrasive Industry*, May.

How the Airplane Will Affect Marketing and Production

At present manufacturers are required to keep certain inventories of stock on hand to guarantee a continuous flow of production. An inventory large enough to give a factor of safety, means that a large amount of capital must be tied up. If parts are subject to infrequent, heavy demands, the airplane is a means of bringing in sufficient quantities to tide production over until a bulk shipment can arrive. By this means a heavy inventory expense can be saved, and by comparison the cost of the air shipment is negligible.

Machine idleness due to breakdowns is expensive. When service is needed on a large, heavy machine having a high idle cost, parts may be rushed in by airplane in a few hours, as against several days required by other means of transportation. The tremendous savings effected make this service worthwhile.

Or again, if because of the greater speed in transportation, the manufacturer is enabled to sell goods over a greater area and in greater volume, he would procure the still greater advantages of mass production and lower cost per unit. If the manufacturer takes advantage of these things, he is enabled to put out a quality product and lessen the cost, and his advantages in the market are obvious. However, if a competitor adopts these methods and he does not, he would be at a decided disadvantage.

The effect of these lowered inventories and the smaller amount of capital required to carry out individual business, would be to bring about an increase in the total working capital of the country. This would mean more projects could be financed and more goods would be produced to fill the ever increasing wants of consumers. Greater business activity and a rising standard of living would result.

With the advantages of the airplane, sales organizations can serve much larger areas, and not only fewer men will be required to do the same amount of work, but fewer offices will be required, and these will be situated at perhaps three or four strategic points.

There is, of course, the factor to be considered that a large-size business is often done because of local offices and close contacts with people, because of the desire on the part of customers to deal with local individuals. But with the increasing use of the airplane as a means of transporting company representatives, we shall see the gradual growing away from provincialism all over the country, and the ever increasing tendency to know and understand people with whom we do business, even though they may be located 1,000 to 3,000 miles from us.—R. L. Putnam, *Management Review*, May.

Management and the Foreman

What does the Management Expect of the Foreman?

1. He should be a leader
2. Co-operate all around
3. Low costs consistent with expected quality
4. Be an organizer
5. Have loyalty
6. Believe in the "square deal"
7. Have discipline in his department
8. Work to a schedule and direct the work
9. Have knowledge of the work in his department
10. Have pride in the work
11. Be neat and orderly
12. Be healthy
13. Assume responsibility
14. Be safe
15. Must not be a "yes" man
16. Should make suggestions
17. Should carry out the company policies
18. Must be on the job
19. Should seek knowledge
20. Must have open-mindedness

What does the Foreman Expect of Management?

1. It should furnish proper equipment for the work
2. Clear instructions and complete information
3. Leadership
4. Co-operation
5. Square deal
6. Support of the management
7. Encouragement
8. Confidence of management
9. Open-mindedness
10. Fair compensation
11. Supply of proper help
12. Proper working conditions
13. Proper materials
14. Opportunity for advancement
15. Constructive criticism
16. Steady job
17. Human interest
18. Opportunity to express himself
19. Consistent policy
20. Responsibilities clearly defined

THESE answers to the two questions given were formulated at the Thirtieth Annual Convention of the National Metal Trades Association in New York on April 26. Instead of delivering a paper, Mr. George Seyler, Vice-President and Works Manager of the Lunkenheimer Company, called on ten executives present to assemble as a conference, to act first as executives, and then as foremen, and discuss the two questions. The ten men acted publicly as a shop conference and the answers were noted on the blackboard as they were decided upon. The executives represented some of the most prominent companies in the country, and the answers show a keen and fair analysis of the whole subject of the relationship of foremen and management

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Trade Associations Play an Important Part in Chamber of Commerce Activities

TRADE associations at last are playing an important part in the affairs of the Chamber of Commerce of the United States. They were endorsed publicly at the recent meeting of the Chamber by a high public official and their position in industry was recognized time and again by other speakers.

This new position of the trade association was not secured by reason of a sudden change of heart on the part of the Chamber. The Trade Association Service, under the leadership of Dr. Hugh P. Baker as manager, the constructive work of certain militant leaders of trade associations in the field, and the organization of trade association executives have meant much to national business, which the Chamber represents. Both groups, therefore, the members of the Chamber and the trade associations, have come to recognize the strategic position of the trade association when it comes to molding business opinion in this country, directly, quickly, and effectively.

Among the principles for American business recommended by the Chamber at its last meeting was that companies or corporations be disciplined for failure to live up to business ethics. Trade associations, of course, are the bodies holding disciplinary power. By the exercise of such power, fairly and bravely, they can so regulate business conduct that it will actually be carried on to conform to the slogan, "What is not for the public good is not good for business."

Now let the trade associations use their power carefully and honestly in order not to destroy this new faith and dependence of the representatives of national business and to add to the prestige already acquired.

The Outside Viewpoint

IT IS becoming almost bromidic to mention the patent fact that an outsider, or a newcomer in an organization, being unhampered by long familiarity with everyday details, can put his finger on wastes that the old hands fail to see. Yet new evidences of the truth of the statement present themselves daily. This one is a little out of the ordinary.

For more than thirty years a big distributing house had operated on regular hours. The busy times and the intervening lulls were taken for granted. A new manager had the curiosity to investigate. As a result the working day was shortened a half hour in summer and lengthened a corresponding amount in winter to take care of seasonal variations. A secondary dull period occurred on Monday. Consequently it was decided to have the whole force quit an hour earlier on Monday and make up the time by working fifteen minutes longer on the following four days. With few exceptions the change was satisfactory to all concerned and the force was reduced somewhat.

A situation of this kind may be unique, but every shop has some sort of a problem that can be attacked profitably by some one with a fresh viewpoint. The progressive companies have taken steps to insure that there shall always be some one around whose ideas are not dulled by too much contact with established routine. The reactionary ones should do so.

Metal in Aircraft Construction

METAL entered so little into the construction of early aircraft that metal working engineers saw little likelihood of the aircraft industry materially affecting them, even should it develop. A study of the planes exhibited in the All-American airplane show in Detroit showed that metal was largely replacing other materials in the whole airplane structure.

Metal, usually steel tubing, now forms the framework of every fuselage or airplane body. Rudder, elevator and aileron frames are now largely of metal, either steel or aluminum. Wing ribs are still of wood in many cases but even there metal is being utilized more and more. Landing gear framework is now almost entirely of metal, and pontoons, for water planes, are seldom made of anything else.

Framework of steel tubing permits the use of welded joints that are easier to make, more durable and better in every way than the old wooden structures. Engine mounts are now almost entirely of steel, tubing in most cases, and there is an increase in the number of planes using sheet aluminum for wing and fuselage covering.

Aircraft engines, too, are increasing in number and it is only a matter of a few years when the aircraft industry will be a real factor in connection with metals and metal working machinery.

· SHOP · EQUIPMENT · NEWS ·

Brown & Sharpe Nos. 30, 32 and 33 Plain Grinding Machines

EASE of operation is featured in this series of plain grinding machines which has been introduced by the Brown & Sharpe Manufacturing Company, Providence, R. I. The Nos. 30, 32 and 33 machines are essentially the same except for the lengths of the beds. The machines take 18-, 36-, and 48-in. lengths, respectively, between centers. The centers will swing objects 12 in. in diam., and will grind them with a 24-in. wheel having a face from 2 to 10 in. wide, or they will take work 6 in. in diam., and will grind it with a 30-in. wheel having faces from 2 to 6 in. wide. Fig. 1 shows the No. 30 machine equipped for straight-in-feed grinding using a 24-in. diam. wheel with a 9-in. face. The spindle-reciprocating attachment, on the right end of the spindle, provides a $\frac{1}{8}$-in. automatic movement of the wheel spindle. The attachment is made non-operative by a convenient lever when not desired.

Each of the Nos. 30, 32, and 33 plain grinding machines is made in two modified forms for work not requiring full automatic functions. The first, known as the "A" machine, has hand operation for the table, with one power table feed for wheel truing. It is particularly adapted to straight in-feed grinding, using either power or hand cross-feeds. The second machine, known as the "B" machine, has only hand table- and cross-feeds. This machine is also used for straight-in-feed grinding, but has hand cross-feed only.

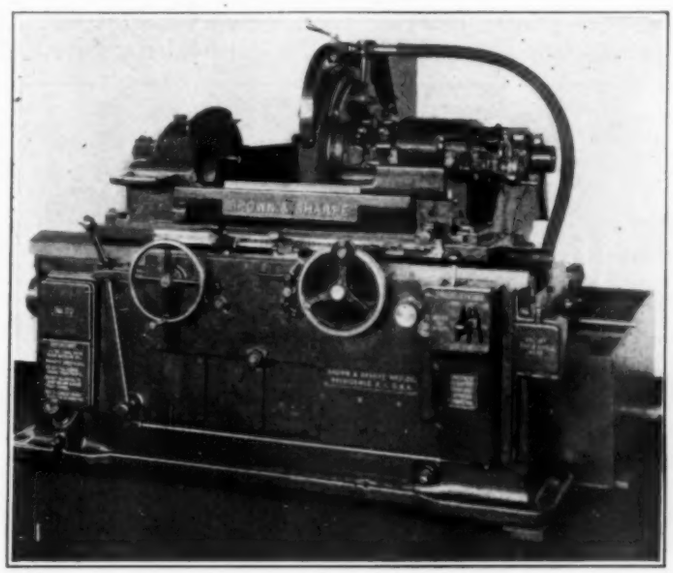
These grinders have been made very heavy to assure a high degree of accuracy, as may be observed from a study of Fig. 2. Care has been taken to make the work drive smooth. This has been accomplished by the combination of a torsion shaft and a belt drive from within the machine. The rugged wheel stand is supported in all positions, and the sliding table is carried on heavy ways carefully protected from grit and coolant. The coolant tank is a unit separate from the machine, yet coming within the floor-space limits.

The machines are essentially production units, possessing a wide range of table and work speeds. Due to a table dwell, which is provided at each end of the table traverse, and a shock absorber in the reversing mechanism, high table speeds can be used without damaging the finish of the work. All control levers are very conveniently grouped at the normal operating position. The complete cross-feed controls for both automatic and hand operation, are located about the handwheel. The table and work speed controls are placed together at the right. On the extreme right is the adjustment for the table dwell. The footstock is of interest in that both spring lever and screw and handwheel operation are provided.

Automatic Lubrication

All moving parts and scraped surfaces are well guarded in all positions, as is shown in Fig. 3. The massive one-piece casting is made with a compartment for the motor when the machine is motor-driven, and is large enough to accommodate a 40-hp. motor. All main operating mechanisms, including the wheel spindle, are automatically lubricated with filtered oil. The heavy wheel slide and wheel-slide base have long, automatically-lubricated ways which assure accurate alignment and full support to the wheel spindle, even at extreme positions. The lubrication of the wheel spindle in all the main mechanisms is by gravity flow of filtered oil from the reservoir shown in Fig. 3, which is kept flooded with oil by a geared pump. The filters are inclosed in the wheel slide and are readily accessible for cleaning.

Either overhead countershaft drive or motor drive is available. From 15



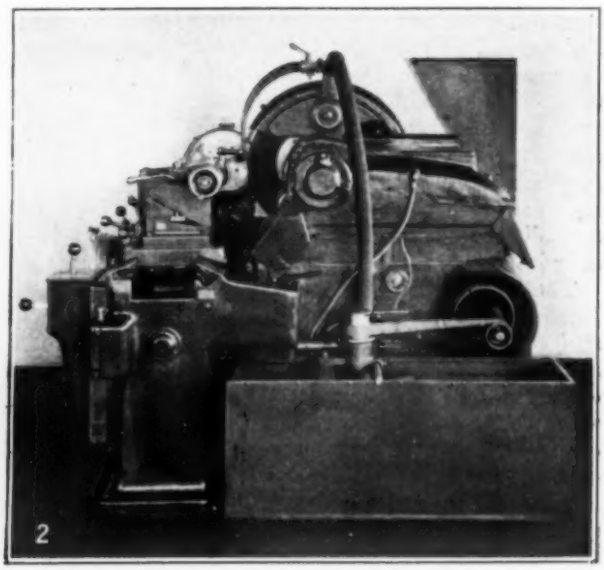


Fig. 1—Brown & Sharpe No. 30 Plain Grinding Machine equipped with belt drive and having all controls centralized
Fig. 2—Right-hand view of the No. 30 machine showing the heavy construction used and the coolant tank

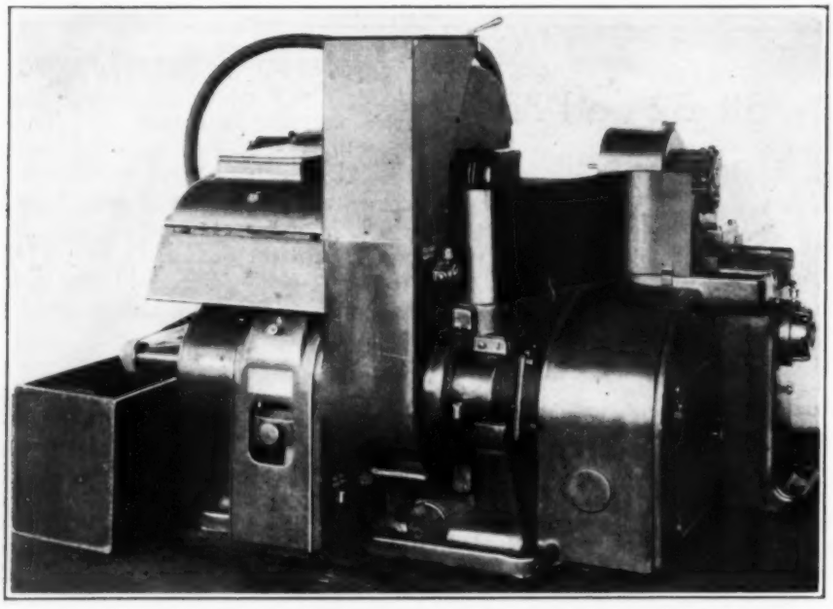


Fig. 3—Rear view of Brown & Sharpe No. 30 Plain Grinding Machine showing hooded motor compartment

to 40 hp. is required by the machine, depending upon the work. The motor compartment is hooded in a way which protects the motor yet affords easy access for lubrication. The control equipment may be mounted on a stand close to the base of the machine, where it is within the space limits.

Pennsylvania Single-Stage Compressor

This semi-portable single-stage, double-acting, multiple-belt driven air compressor has been developed by the Pennsylvania Pump and Compressor Company, Easton, Pa. The equipment includes motor with automatic stop and start control, multiple-belt drive, air receiver and air filter assembled into a compact unit occupying small floor space. The air cylinder and all working parts are automatically lubricated.

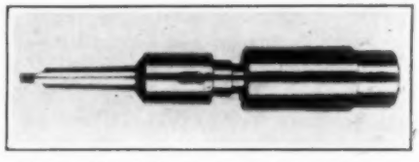
The compressor is equipped with Pennsylvania air-cushioned valves, and contains all other features that are built into the standard line of compressors. The unit is equipped with a 10-hp. high-torque motor operating the compressor at a speed of 400 r.p.m. The piston displacement is 65 cu.in., and the pressure is automatically controlled between 85 and 125 lb. per sq.in. The unit was designed to meet the demand of the service station and garage as well as that of the small machine shop. Overall dimensions are: length 6 ft. 6 in., width 2 ft. 4 in., and the weight is 1,360 pounds.

Aloxite Large-Diameter Crank-Grinding Wheels

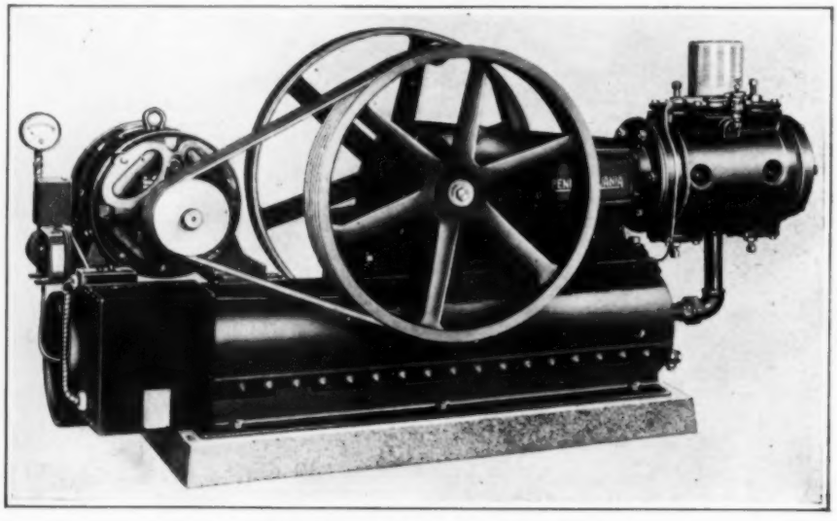
Vitrified Aloxite abrasive wheels of extra large diameter are being placed on the market by the Carborundum Company, Niagara Falls, N. Y. These wheels are especially designed for the grinding of automotive crankpins and crank bearings, and are made in 36- and 42-in. diameters. The 36-in. wheels can be furnished in thicknesses down to 1¼ in., and the 42-in. wheels in thicknesses down to 1½ in. The crank-grinding wheels are claimed to be the largest thin-faced wheels yet developed, and were brought out to meet the needs of the automotive industry for a wheel that would finish a great number of pieces with a minimum of wear. The wheels are made to accurate dimensions, with perfect balance, and are said to give a better finish than can be obtained with the smaller wheels formerly employed. They are adapted to all standard machines.

Apex Vertical-Float Friction-Drive Chuck

For multiple tapping of bottom holes, this vertical-float friction-drive chuck has been introduced by the Apex Machine Company, 300 Davis Ave., Dayton, Ohio. When this device is used, if a tap sticks or strikes bottom, the friction will be overcome and slippage will result, while the float takes care of the spindle travel. The friction unit consists of a multiple-disk clutch which, when ad-



Apex Vertical-Float Friction-Drive Chuck



Pennsylvania Single-Stage Compressor

justed will maintain a setting over a period of weeks. The thrust of the spindle does not in any way affect the friction. This chuck uses quick-change collets in which the tap is free to float.

The chuck is made in two sizes; Type MA having a capacity for $\frac{3}{8}$-in. taps, the outside diam. being $1\frac{5}{16}$ in., and Type MB, having a capacity for $\frac{3}{4}$-in. taps, and an outside diam. of $1\frac{7}{8}$ inches.

Heald "Gage-Matic" Internal Grinding Machine

COMBINING the principle of its regular "Size-Matic" internal grinding machine with that of the "Tero-Matic," recently acquired from the Giddings & Lewis Machine Tool Company, the Heald Machine Company, Worcester, Mass., has brought out a machine known as the "Gage-Matic" to cover the range of small machine parts, such as gears, rings for ball-bearings, bushings, etc., the bores of which are now so universally finished by grinding. The Size-Matic machines were described on page 377, Vol. 64, and the Tero-Matic machines on page 928, Vol. 58, of the *American Machinist*.

The base and the wheelslide of the Gage-Matic are those of the Size-Matic with minor changes in the feed mechanism. The workhead embodies the principles of the Tero-Matic in that it gages the size of the hole being ground by means of a positive plug gage, and indicates the moment for withdrawing the wheel and stopping the machine, upon completion of the work. The same principle of electric control, and the same electric-control mechanisms are found upon this machine as upon the standard Heald machines of this type.

The cycle of the machine is automatic from the moment of tripping the starting lever after the work piece has been set into the chuck, collet or other work-holding device, until the hole has been ground accurately to size, the wheel withdrawn and the machine stopped in position to allow the piece to be removed. It is self-contained; it carries within or upon itself the hydraulic pumps to drive the reciprocating mechanism, supply cooling compound to the wheel and work, and an electric generator to supply current to operate the electric controls. It may be driven by a single belt from a countershaft, or it may be provided with two or with three electric motors, as desired.

On the two-motor drive machine, the driving motor is mounted on the back of the cabinet base. It has a double-end rotor shaft, one end of which is coupled directly to the hydraulic pump and also drives both the generator and coolant pump, the other end of which carries a pulley from which a belt drives the work spindle. On the three-motor machine a small motor is mounted upon the headstock to drive the work spindle. In either case the grinding-wheel spindle is driven by a separate electric motor carried upon and traveling with the wheel slide.

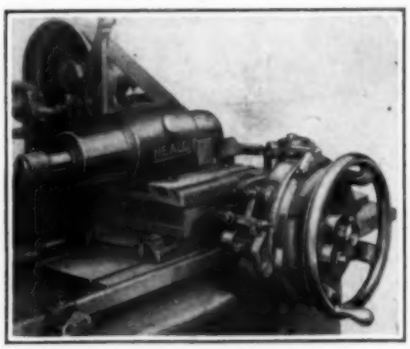


Fig. 3—The wheel slide and feeding mechanism

The workhead carries the automatic plugging device by which a sizing disk is presented to the inner end of the hole being ground at each reciprocation of the wheel slide. When the diameter of the bore reaches the predetermined size the plug actually enters the hole, and by so doing sets in motion the electric controls to stop the cycle and bring the machine to rest. The plug is withdrawn mechanically from proximity to the hole each time the wheel passes through the bore, and hydraulically when the cycle goes out of action.

The work spindle has at its front end a $9\frac{1}{2}$-in. diameter flange, or faceplate, to which fixtures for different kinds of work may be easily attached. The spindle is carried upon radial ball-bearings of large diameter, designed to eliminate the necessity for re-adjustment. The belt pulley is carried upon separate bearings so that the spindle is not subjected to side strain due to belt pull. A conveniently placed lever engages a multiple-disk clutch to stop and start the spindle. A similar clutch serves as a brake to stop the rotative movement quickly when the same lever is moved in reverse direction.

A front view of the machine, Fig. 1, shows the hydraulic-control mechanism by which the movements

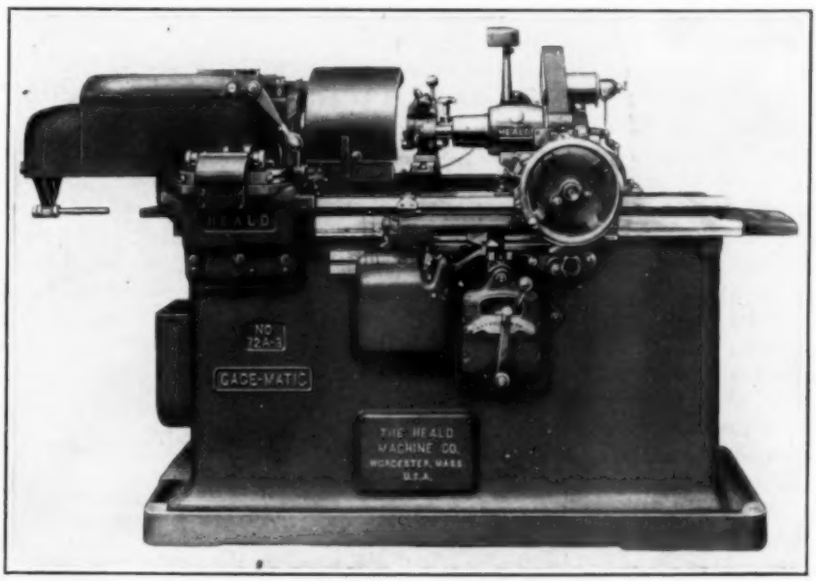


Fig. 1—Heald "Gage-Matic" Internal Grinding Machine showing the hydraulic control mechanism

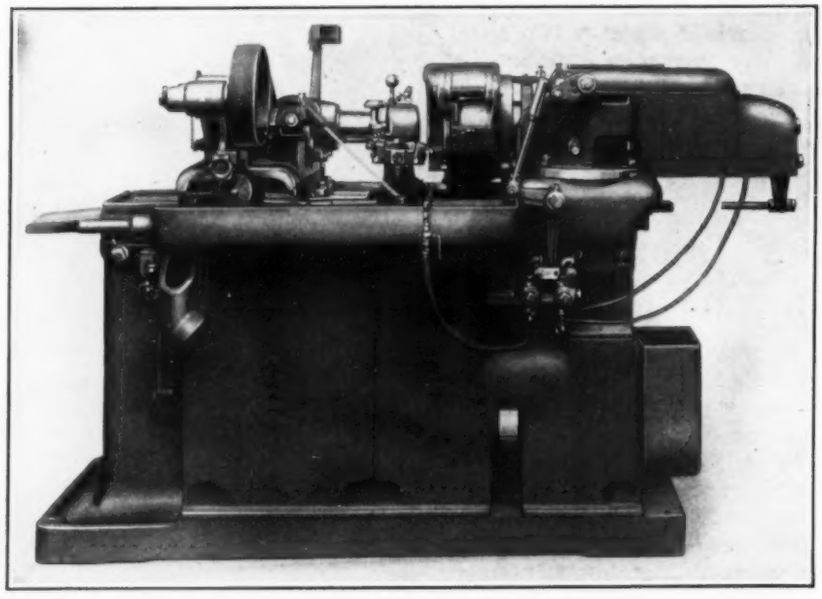


Fig. 2—Rear view of the machine showing easily removable guards

of the wheel slide are governed. The range of this movement is easily adjusted to any length within the capacity of the machine by means of movable stops on the front of the table. The rate of reciprocation is controllable from 0 to 44 ft. per min. without steps by moving a single lever. The cross movement of the wheel, corresponding to the diameters of bores ground, is actuated by a cross-screw of large diameter and comparatively fine pitch in conjunction with a large ratchet wheel and micrometer-graduated dial. The wheel slide moves on one flat and one V-way, fully covered to exclude dust, and is lubricated by oil from a constant-pressure pump.

In Fig. 2 is presented a rear view of the belt-driven machine. The pumps and generator are mounted upon the back of the cabinet, where they are fully covered by easily removable guards which protect them from accidental injury. With the guards removed, all of the mechanism is exposed, including the joints in the hydraulic piping and the electrical connections, so that any part is instantly accessible.

The wheel slide may be seen separately in Fig. 3 which shows the means of feeding the wheel in increments of 0.0001 in. and larger, to increase the diameter of the bore being ground by successive passes of the wheel. When a size a predetermined amount below the finish size is reached, an electric contact is made which causes the slide to withdraw the wheel from the work, and lowers a diamond before the wheel in position to dress it. At the same time the traversing speed of the slide is reduced, and the wheel caused to make one or more passes before the diamond to restore its shape. The diamond then rises out of the path of the wheel, and simultaneously the wheel returns automatically to the work and continues to grind until the sizing plug enters the hole from the rear, when the wheelslide moves to the right a distance sufficient to permit the work to be taken out of the chuck without interference as the cycle goes out of action. As the wheel makes its final withdrawal a guard swings down to inclose it, so that the operator is not in danger of injury by accidental contact with it.

The workhead to be seen in Fig. 4 incloses all the working parts. It is mounted upon a swiveling base that is provided with large opposed screws to adjust its position so that work may be ground parallel. The gaging mechanism, a part of which may be seen to the left in this illustration, extends through the hollow work spindle, and is fitted at its inner end with a single gaging disk of a size corresponding to the desired diameter of the ground bore. By transferring to the wheelslide, the duty of determining the correct instant to dress the wheel as is done in the Size-Matic, it is possible to use one gage only, instead of two of different size as in previous models of the Tero-Matic, and the length of work that can be ground and gaged is materially shortened thereby.

The new machine covers a floor space of 114x56 in., and weighs 4,800 lb. It swings work 15⅜ in. in diam. over the table and 11½ in. inside the standard water guard. It has a capacity to grind holes 5 in. in diam. in any length up to 8⅜ in., depending upon the shape to be ground. There is a 1 1/16-in. hole through the spindle, partly occupied by the gaging bar, by which water is delivered to the work and wheel.

As the machine is primarily designed for mass production, the rotative speed of the work spindle is

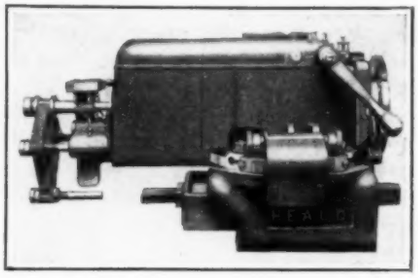
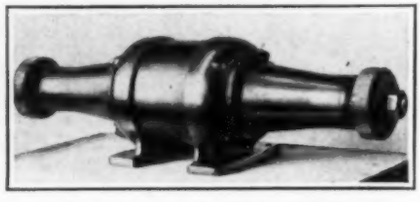


Fig. 4—The inclosed work head and part of the automatic gaging device

intended to remain constant at a rate best suited to the particular work in hand. This speed should be specified by the purchaser and may range from 230 to 860 r.p.m. A multiple-speed countershaft is furnished with the belt-driven machine, if desired, by which a range of speeds is available.

Forbes & Myers No. 204 High-Speed Grinder

High-frequency current is now being used in many plants to drive grinding machines at very high speeds. Because of this trend, this No. 204 high-speed grinder has been introduced by Forbes & Myers, 172 Union St., Worcester, Mass. This



Forbes & Myers No. 204 High-Speed Grinder

machine is of the double-ended type and carries a 4-in. wheel mounted directly on the motor shaft as shown in the illustration. It is driven by a ¼-hp. motor running in four ball bearings at a speed of 5,400 r.p.m. It operates from a 180-cycle source. Other grinders of the same type are offered to drive wheels from 1 to 6 in. in diam. at speeds of 3,600 to 12,000 r.p.m. The motor used is similar to other induction motors.

Fay & Egan No. 560 Single-Cylinder Surfacer

BOTH hard and soft wood may be given a high-grade finish by this electrically-driven, single-cylinder surfacer which has been developed by the J. H. Fay & Egan Company, Cincinnati, Ohio, particularly for pattern shops. The machine is shown in the illustration. The head will handle stock up to 24 in. in width, and 8 in. in thickness.

The finishing is accomplished by means of a single cylinder which is machined from an open-hearth steel forging, and is fitted with three air-hardened, tungsten-steel knives. The knives are held in position with screw pressure against a wedge block so that a uniform pressure is distributed over the full length of the knife. Micrometer-adjusting screws in the head enable the operator to set out each end of the knife a uniform distance, thus maintaining the balance. The cylinder rotates at 3,600 r.p.m., and is driven by a 5-hp., 2- or 3-phase motor mounted directly upon the spindle. The motor operates at 60 cycles, 110, 220 or 440 volts. Push-button control for the motor is placed in the frame within easy reach of the operator. A control panel built into the frame includes both overload and low-voltage protection.

The feed consists of four rolls, all driven by power, and speeds of 18 and 30 ft. may be obtained easily by means of a shift lever mounted on the front of the machine. The rolls are driven from the cylinder by means of a long, combination wedge-contact link belt through cut steel gears. Pressure is maintained by automatic graduated spring levers.

The entire mechanism is housed in a "safety-sealed" cabinet, no parts being exposed or requiring auxiliary guards. Removable plates are provided to give access to all parts. A safety bar is mounted in front of the upper feed in roll so that only one board can be put in the machine at a time. Pressure bars are provided before and after the cylinder acting close to the cutters, and with close centers of the rolls, enabling the production of good work on very short stock. The feed rolls are 3 in. in diam. and the center to center distance between them is 9½ in. For feeding a number of pieces through the machine, varying up to ⅛ in. in thickness at one time, a flexible sectional roll and sectional chip breaker may be furnished. The machine occupies a floor space of 44x65 inches.

Fay & Egan No. 560 Single-Cylinder Surfacer

Rivett Horizontal Belt Lathe Drive

Countershaft vibration has been much reduced by this compact, horizontal bench lathe drive which has been introduced by the Rivett Lathe and Grinder Corporation, Boston,

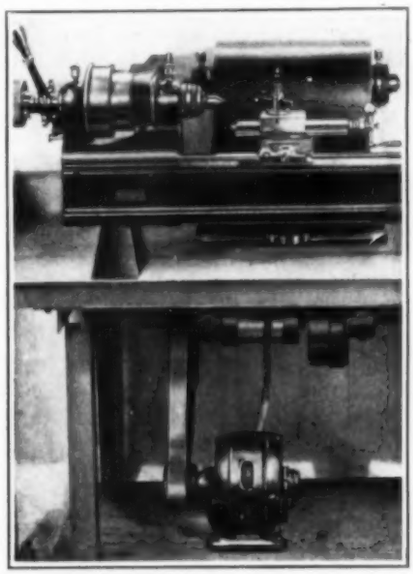


Fig. 1—Rivett Horizontal Bench Lathe Drive showing the belt cover in place, the motor and motor jackshaft

Mass., and the use of endless belts by which higher speeds may be obtained, is permitted. In addition, it also permits a saving in the length of belts and removes the element of danger if they should break. Furthermore, since bench lathes are commonly mounted against windows, a saving in light is effected by eliminating overhead countershaft belts. Fig. 1 shows this safety drive for bench lathes with

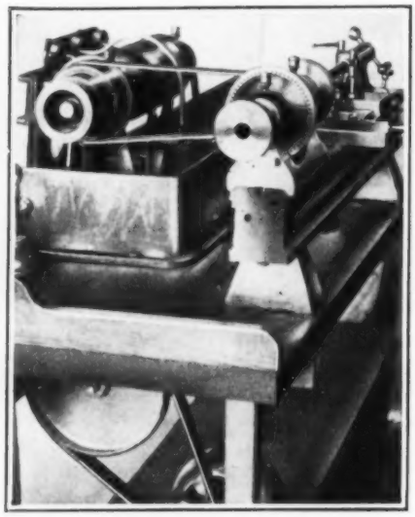


Fig. 2—The horizontal belt drive with cover removed to show the arrangement of the belts

the individual motor, jackshaft and countershaft with the cover in place. Fig. 2 presents another view of the same apparatus with the belt cover removed to show the arrangement.

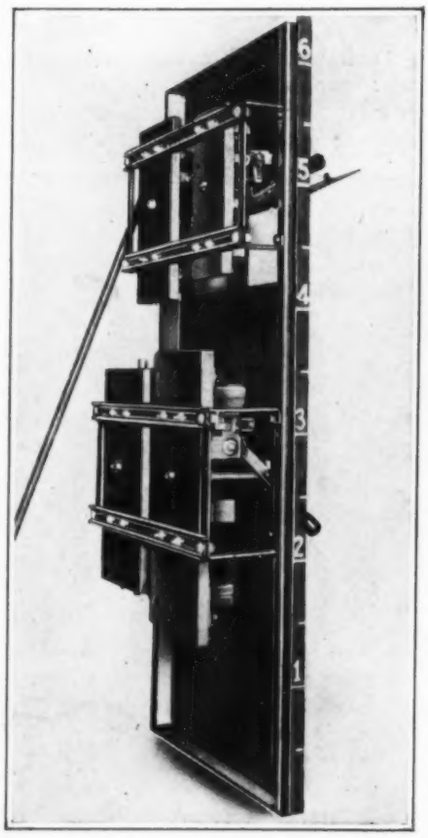
The foundation of the drive is a heavily-ribbed countershaft base that has bolted to it a countershaft bracket, which is mounted on a fulcrum rod extending through the sides of the heavy cast-iron bench guard. A rod, carrying adjusting nuts that bear against the front face of the bench guard, provides means for drawing forward the lower edge of the countershaft base and consequently swinging back the upper part of the base which carries the countershaft brackets. This rocking motion tends to tighten the horizontal belt which drives the lathe headstock, and also to tighten the vertical belt, from the motor jackshaft mounted under the bench. When the tension adjustment has been made by the tightening rod, a nut on the end of the fulcrum rod is tightened, thus clamping the side of the bench guard against the countershaft base so that a rigid countershaft mounting is effected. The enameled sheet-iron belt guard, shown in Fig. 1, extends from the front edge of the bench guard over the countershaft pulleys and belts, and is attached by two thumb screws to the top edge of the countershaft base. This belt guard is so designed as to permit full swing of the countershaft throughout the adjustment range without interference.

The horizontal safety drive is believed by the manufacturers to give the advantages of a geared head lathe to an ordinary bench lathe by giving a smoother drive which is particularly desirable in high-grade precision work. The safety drive is applicable to bench lathes of the Rivett or other manufacture. Patent application has been made for this apparatus.

Westinghouse Type BB Back-of-Board Switches

Safety in switching operations of the low-voltage class is met by this line of type BB back-of-board knife switches which are being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These switches are mounted on steel panels of the dead-front type and are particularly adapted for industrial control and central station auxiliaries. Four of these devices of various capacities are shown grouped upon the switchboard illustrated.

Each switch and its operating mechanism is mounted on a slate base behind the steel panel with only the operating handle passing through the panel. Complete accessibility of the switch and fuses from the front of the switchboard is provided by means of a fuse door. This is interlocked with the switch handle so that the switch must be in the full open position before the fuse door can be opened, and the switch cannot be closed while the door is open.

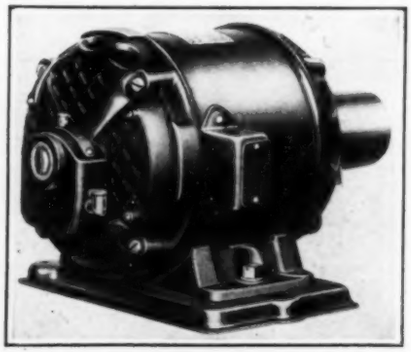


Four Westinghouse Back-of-Board Switches mounted on a steel panel

These switches are available in a large number of combinations. They are made for 250 volts d.c. and 500 volts a.c. and for capacities ranging from 30 to 800 amp. They can be obtained in one-, two-, three-, or four-pole units, fused or unfused, and with or without quick-break attachments.

Century Type DM D.C. Motors

Quiet operation of the type DM d.c. motors is assured since magnetic noise is reduced to a minimum while vibration is eliminated by giving the armatures both a static and dynamic balance. These motors are manufactured by the Century Electric Company, St. Louis, Missouri, and are built in standard sizes of $\frac{1}{6}$ to $\frac{1}{2}$ hp. at speeds corresponding to standard speeds of a.c. motors. They are designed for a temperature rise not to exceed 40-deg. Centigrade.



Century Type DM D.C. Motor

The field is a two-pole laminated steel structure with the compound-wound field coils placed on forms both insulated and taped. The armature slots are insulated with alternate layers of fish paper and varnished cambric, and hardwood wedges are used to retain the coils. Both field and armature coils are wound with cotton-enamel wire impregnated with insulating paint.

The brushes are carried in a box-type holder attached to the field frame and do not require adjustment during their life. The bearings are of cast phosphor-bronze, and have machine-cut figure-8 oil grooves to insure continuous distribution of oil over the entire bearing surfaces. The Century wool-yarn system of lubrication assures at least one year's continuous operation without reoiling. These motors are suitable for small machine tools.

Dexter Tank-Car Outlet Valve Reseating Machine

Reseating of outlet valves may be carried out without removing them from the tank car by the use of the Dexter reseating machine manufactured for the purpose by the Leavitt Machine Company, Orange, Mass. Only one man is required to set up and operate the machine inside of the tank car. It is claimed that an unexperienced operator reseated a seatless valve in 12 minutes. The ease with which the apparatus can be used is shown in the illustration.

The machine is made in two sizes suitable for repairing 4- and 6-in. valves, respectively. It consists of a universal chuck for centering and holding the valve. In addition, the chuck back is used as a guide for the cutter. It is equipped with both feed nut and lock nut which give a positive feeding arrangement. A few rotations of the cutter and a new seat is recut. The blades are especially designed for the purpose and they can be supplied with any desired cutting angle.

Dexter Tank-Car Outlet Valve Reseating Machine shown in use

Aloxite-Redmanol "Super-Speed" Snagging Wheels

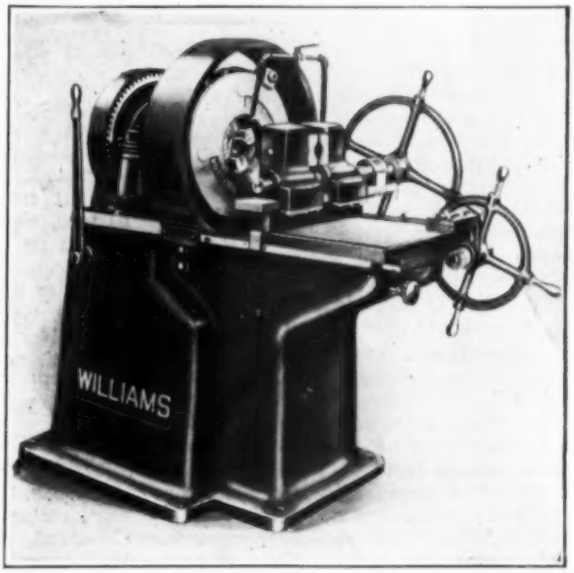
A "Super-Speed" grinding wheel recommended especially for snagging operations has been placed on the market by the Carborundum Company, Niagara Falls, N. Y. The wheel is made of Aloxite aluminous abrasive bonded with Radmanol, a synthetic phenol resin which acts as a tough, tenacious bonding agent. The wheels are claimed to run safely at 9,000 surface feet per minute.

The super-speed wheels are stated to be open, porous, free-cutting, and of great durability. Wheels with arbors of 5 in. diameter or larger are fitted with one or two steel protection rings for added protection.

Williams "Rapid Rotary" Pipe Threading Machine

Bent pipe and nipples can be threaded on this "Rapid Rotary" pipe threader which has been placed on the market by the Williams Tool Corporation, Erie, Pa. Pipe sizes from 1 to 4 in. nominal size are covered by the use of four sets of dies, although ½ and ¾-in. pipe can be threaded easily by means of the substitution of a special set of dies for these sizes. This machine, at the same time as the threading is done, reams the burr formed in the pipe during the previous cutting-off operation. Greatly increased production over previous models is featured. The Rapid Rotary was designed to give an average spindle speed of 19 surface feet per minute regardless of the size of the pipe to be threaded. After the dies have been run full on to the pipe, that is, just as the thread is finished, an automatic tripping device consisting of a cam and lever throws the dies open. This device is controlled from the front of the machine. The mechanisms controlling the chucking and releasing operations are simple and enable a saving in set-up time. Furthermore, the dies have been designed to use as little tool steel as possible so that die costs on production runs will not be excessive.

As will be noted in the accompanying cut, the machine is made very heavy to obtain the requisite rigidity. All gears are inclosed and run in a continuous bath of oil.

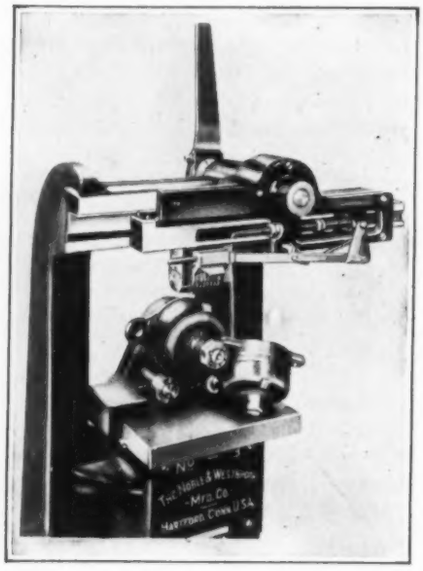


Williams "Rapid Rotary" Pipe Threading Machine

Noble & Westbrook Special No. 3 Marking Machine

Serial numbers may be pressed upon curved surfaces by means of this special No. 3 hand-operated stamping machine which has been placed on the market by the Noble & Westbrook Manufacturing Company, Hartford, Conn. The parts being marked in the illustration are hydraulic shock absorber pieces.

The machine, which is a combination of devices produced by the same mnaufacturer, has a numbering head which is fitted with a special shank to adapt it for use in a reciprocating attachment. The automatic tripping



Noble & Westbrook Special No. 3 Marking Machine

device is attached to the numbering head and changes the number to the next highest one after a mark is made. The marking of the serial number is accomplished by the forward stroke of the numbering head over the part to be marked, this part revolving on its own center on roller bearings. The wheels in the numbering head can also be operated independently by disengaging the tripping device in case duplicate numbering is to be done. These equipments can be furnished for marking many different sizes and styles of parts.

Trade Catalogs

CHAIN DRIVES. The Boston Gear Works, Norfolk Downs, Mass., has published a catalog known as "Renold-Boston Chain Drives" which describes compound-reduction drives, silent chain drives, duplex-roller chain drives and single-roller chain drives. Selection charts for various horse-power ranges and speeds are included. Many types of applications are shown pictorially. Material is included on the care and lubrication of these drives. The catalog contains 56 11x8-in. pages.

COMPRESSORS AND VACUUM PUMPS. The Ingersoll-Rand Co., 11 Broadway, New York, has announced a publication known as bulletin No. 3150 which describes types ER and FR compressors and vacuum pumps. The compressors are of the straight-line type, and are built in single-stage, two-stage or three-stage units. The vacuum pumps are single-stage machines. Both of these machines of the ER type are either belt driven or direct connected while the FR-type units are steam driven. Each type of machine is illustrated by a photograph, and certain assemblies are also shown. Tables of the sizes and capacities are appended. The catalog contains 44 11½x8-in. pages.

CONTROLLERS. The Monitor Controller Co., Baltimore, Md., has published bulletin No. 110, showing the advantages resulting from automatic control of production equipment. Both a.c. and d.c. control equipment for various applications are shown by means of photographs. The catalog contains 19 8½x11-in. pages.

DEEP PIERCING. The National Machinery Co., Tiffin, Ohio, has published Talk No. 66 entitled "Forging-Machine Die Design for Deep Piercing," by E. R. Frost, president of the company. This paper was delivered before the annual convention of the American Society for Steel Treating, 1927. The paper describes the problems encountered in progressive deep piercing, and shows the die designs for producing certain pieces. It contains 44 photographs and twelve 11x8½-in. pages.

DRAWING FILES. The Globe-Wernicke Co., Cincinnati, Ohio, has published a 24-page booklet on its system for the filing and indexing of maps, plans, drawings and similar large sheets. A number of illustrations and various types of filing units are shown.

FLATTENING MACHINES. The Torrington Mfg. Co., Torrington, Conn., has issued a bulletin describing the principal features of its line of flattening machinery for strip and sheet metal. A table of the standard specifications on the line gives the number of rolls, the capacities, the roll lengths and the power requirements of each machine. Photographs illustrate the various types. The booklet contains four 11x8½-in. pages.

HANDLING EQUIPMENT. The Elwell-Parker Electric Co., Cleveland, Ohio, has published catalog No. 170 under the title of "Tructors," which describes about one-half of its line of material-handling equipment. The equipment illustrated includes self-loading lift trucks with capacities up to 10 tons, electric elevator trucks in capacities up to 6 tons, heavy-duty portable electric cranes, platform trucks in capacities up to 3 tons in both 3- and 4-wheel types, and tiering trucks for tiering boxes and rolls. All the preceding equipment is electrically operated, and is illustrated by means of photographs. Many of the trucks are shown in use. The catalog contains 39 11x8-in. pages.

MOTORS. The Reliance Electric & Engineering Co., 1053 Ivanhoe Road, Cleveland, Ohio, has published bulletin 1087 describing and illustrating several inclosed-type motors for various applications. Photographs of the various motors and the drives into which they are incorporated are given. The bulletin contains four 11x8-in. pages.

SAWS AND MACHINE KNIVES. The E. C. Atkins & Co., 402 South Illinois St., Indianapolis, Ind., has published catalog No. 20 which is a 256-page book bound in cloth boards. This beautifully printed catalog shows many types of saws such as circular mitre saws, bandsaws, dado heads, slitting saws, slotting saws and milling saws. Machine knives of various types are also shown. In addition the line of Atkins "Kuik-Kut" metal-cutting machines are illustrated together with metal bandsaws. The catalog is profusely illustrated by means of fine photographs.

SILENT CHAIN DRIVES. The Link-Belt Co., 300 W. Pershing Road, Chicago, Ill., has published booklet No. 812 showing the use of silent chain for machine tool drives. The application of the recently developed automatic idler or vibration damper is shown by means of several drawings and photographs. Many different types of machine tools are shown with the Link-Belt chain incorporated in the drives. The bulletin contains 35 8x5-in. pages.

SMALL TOOLS. Butterfield & Co., Division of Union Twist Drill Co., Derby Line, Vt., has issued catalog No. 20, describing its line of taps, dies, screw plates and reamers. These tools are presented in a great many varieties. Each type is illustrated by means of a photograph and has a table which shows the various sizes and other pertinent data. The catalog contains over 160 tables on commercial tap sizes and tolerances, drill sizes and weights of bar iron. The booklet is indexed and contains 212 9x4½-in. pages.

STEEL STRINGERS. The Midwest Steel & Supply Co., Inc., Bradford, Pa., has published bulletin SC-2 describing methods of supporting overhead equipment such as machinery, motors and hangers for line shafts by means of steel stringers. Various steel stampings to adapt these stringers to various applications are shown. The methods of supporting stringers for various uses are shown by means of drawings. The bulletin contains four 8x11½ in. pages.

SURFACE GRINDER. The Blanchard Machine Co., Cambridge, Mass., has published a bulletin on its No. 16 high-power surface grinder, which contains an excellent pictorial description of the machine. The grinding of many different types of work is shown by means of photographs. Various types of attachments are illustrated. The bulletin includes both specifications and dimension sheets showing the space occupied by these machines when driven directly by motor or from either an overhead countershaft or motor. It contains 31 11x8½-in. contains 37 11x8-in. pages.

NEWS OF THE WEEK

Sperry Nominated to Lead Mechanical Engineers

ELMER A. SPERRY, chairman of the board of directors, Sperry Gyroscope Co., Brooklyn, N. Y., headed the list of nominees for officers of the American Society of Mechanical Engineers handed down by the nominating committee at the Spring Meeting of the society, held in Pittsburgh, May 14-17. He was also the recipient of the Holley Medal which was presented at the banquet held on Wednesday evening. The other nominees were: for vice-presidents, William Elmer, special engineer, Pennsylvania R.R.; Robert L. Daugherty, professor of mechanical engineering, California Institute of Technology, Pasadena; Chas. E. Gorton, chairman, American Uniform Boiler Law Society, New York; for managers, Charles M. Allen, Worcester; Robert M. Gates, New York; Ely C. Hutchinson, San Francisco. Delegates to American Engineering Council are: Elmer A. Sperry, Brooklyn; E. O. Eastwood, Seattle; Dean E. Foster, Tulsa; W. P. Hunt, Moline; O. P. Hood, Washington, D. C.; Charles Penrose, Philadelphia; Frank A. Scott, Cleveland; Max Toltz, St. Paul; E. N. Trump, Syracuse; and D. Robert Yarnall, Philadelphia.

One of the interesting features of the meeting was the presentation of the Lincoln Arc Welding Prizes, described elsewhere in this issue.

The usual complete and diversified program of technical sessions occupied Tuesday and Thursday mornings and all day Wednesday and the other afternoons were devoted to visits to neighboring industrial plants.

Technical Papers

Of particular interest to men in the metal working field were the session sponsored by the Machine Shop Practice Division, at which papers by E. F. DuBrul, general manager, National Machine Tool Builders' Association, and Thomas Barish, assistant chief engineer, Gurney Division, Marlin-Rockwell Corporation, were presented, and the sessions of the sectional committee on the standardization of small tools and machine tool elements.

Mr. DuBrul pointed out the effect of inflation of currency in creating illusions as to depreciation accounting and showed the fallacy of the usual accounting practice which takes into account a depreciation allowance based on the original costs of fixed assets. He showed the necessity of calibrating the dollar measure of value consumed during each period, to allow for changes in the purchasing power of the dollar.

Mr. Barish described the three main types of ball-bearing machine tool spindles: The two-bearing, manually adjusted; the automatically spring adjusted; and the three-bearing, adjustable and non-adjustable, and compared their characteristics.

The standardization committee reached a decision to adhere to a single standard of machine tapers and appointed a technical committee to work out the details. It also reorganized by electing an executive committee composed of Harry E. Harris, chairman; F. O. Hoagland, vice-chairman; J. A. Auglala, secretary; and Messrs. Machon and Spicer.

Business Should Purge Itself of Dishonesty

Among the resolutions adopted by the Chamber of Commerce of the United States at the closing session, on May 11, of its sixteenth annual meeting at Washington, D. C., were the following in relation to dishonest business practices:

"The Chamber of Commerce of the United States declares its confidence in the general integrity and sound ideals of modern business.

"American business is jealous of its good name, insists upon protecting its professional status by the maintenance of the highest standards, and intends scrupulously to discharge its collective responsibilities.

"Chief among such responsibilities is that of purging business of all those who indulge in commercial and political corruption and through resort to unclean or unworthy practices bring business into disrepute and shock the sensibilities of all decent citizens.

"The Chamber declares that the moral turpitude of corrupters of public servants is even greater than that of those whom they debauch.

"The Chamber emphasizes its principle of business conduct which provides that 'corporate forms do not absolve from or alter the moral obligations of individuals.' It maintains that stockholders of corporations owe it to themselves, to the government, and to the profession of business publicly to repudiate those who misrepresent them. Such stockholders cannot accept the profits flowing from corruption and escape the moral stigma which inheres in such profits. Neither can they permit those who act for them to profit personally through corrupt corporate transactions, or shield others who do.

"The Chamber reaffirms its allegiance to the principles of business conduct adopted at its annual meeting in 1924; and particularly does it reaffirm the principle that 'business should render restrictive legislation unnecessary through so conducting itself as to deserve and inspire public confidence.'

"Rapid industrial development has resulted in productive capacity in some branches of industry in excess of current requirements. In order that industrial development may proceed along sound lines, and be in the public interest, each field of manufacturing industry should have knowledge of the true costs of production and distribution based upon uniform cost accounting and should collect and distribute to its members and the public, through its trade associations, reliable data as to orders, shipments, stocks, and other facts essential for an understanding of the situation in the industry.

"Commercial organizations and other agencies interested in promoting new industries for their communities should always obtain and consider such current economic facts before encouraging development of additional capacity for production in any field of industry."

The Chamber also went on record as:

Opposing the government in business.

Opposing legislation limiting the power of the Federal courts.

Advocating a reduction in corporation tax to 10 per cent.

Urging the improvement of Federal tax laws.

Urging legislation for the encouragement of shipbuilding and operation by responsible private interests.

Advocating the placement of "educational" orders for munitions and equipment to familiarize manufacturers with the work.

Concurring in the policies of the Department of Commerce in the promotion of commercial aviation.

Advocating international commercial arbitration.

James W. Owen Wins Lincoln Welding Prize

The Lincoln Arc Welding Prize donated by the Lincoln Electric Co., of Cleveland, Ohio, and presented through the American Society of Mechanical Engineers, has been won by James W. Owen, director of welding for the Newport News Shipbuilding and Dry-

dock Co., at Newport News, Va. The prize of $10,000 was presented by Alex E. Dow, president of the A.S.M.E., and L. P. Alford, chairman of the committee of judges at the spring meeting of the society held at Pittsburgh. It was awarded for excellence of a treatise on arc-welding design, shop practice, and analysis of its industrial application and world-wide possibilities.

Two other prizes were presented, one to Prof. Henri Dustin, of the University of Brussels, Belgium, and the other to Commander H. E. Rossell, of the United States Naval Academy at Annapolis. Prof. Dustin won $5,000 for his paper on fundamental principles of arc welding, and Commander Rossell won $2,500 for his paper on electric welding in ship bulkheads and similar structures.

New High-Speed Cutting-Tool Metals Interest British Metal Workers

Some records established by German and English products

By Our London Correspondent

AS REGARDS the machine tool trade here, the commercial side has shown no definite change of late, one way or the other. It is the technical side that at the moment presents an aspect of interest, for users of machine tools are not wanting who assert that the tool once more is ahead of the machine. All depends on the machine, however.

Thus metal cutting at unusually high speeds was shown at the recent Leipzig Fair and received attention. There, with Widia, a new German material, cutting speeds of 560 ft. per min. were employed on mild steel, the cut in one test exceeding 0.3 in. depth with a feed of 0.015 in. per rev. Higher speeds were used on cast iron of 200 Brinell hardness. In one demonstration, with the same depth of cut and feed of 0.032 in., the speed was 780 ft. per min. In fact cutting was done at yet higher speeds, but an attempt at 300 metres per min., that is, about 1,000 ft. per min. was not a success.

In Great Britain, S. Osborn & Co., Ltd., of Sheffield, have introduced "B.V.," a new material which, unlike the German material, can be heat-treated and machined in much the same manner as ordinary 18 per cent tungsten high-speed steel. A tool of this material has cut nickel-chrome steel of 285 Brinell hardness at 40 ft. per min. with a depth of cut of $\frac{3}{8}$ in. and $\frac{1}{16}$ in. feed per rev. It ran for 60 min., removing, according to calculation, about 3.15 lb. per min. The tool was still in a good cutting condition but no attempt was made to test it to the limit. Another tool of the same material turned toughened non-magnetic manganese steel at a cutting speed of 9 ft. per min., the feed being $\frac{1}{32}$ in. per rev. and the depth of cut $\frac{1}{16}$ in. for 6 min., when it was increased to $\frac{1}{8}$ in. The total length of the run was 9¼ min., when the end of the test piece was reached. The tool was still cutting, though with a tendency to run off. The $\frac{3}{4}$-in. web of a manganese steel rail has been drilled with a 1-in. flat drill, fed by hand, running at 32 r.p.m., the time taken being 6½ min. The B.V. material has been used for some little time for truing-up brake-hardened locomotive tender tires at 36 ft. per min. with $\frac{1}{16}$ in. traverse. The same material has been employed for re-cutting chilled iron rolls at a speed of 10½ ft. per min., the metal being removed at the rate of 30 lb. per hour. As compared with high-speed steels, the claim is that the new material will machine harder materials and also that higher speeds and heavier cuts can be employed.

Reference has been made to the Leipzig Fair. The interest of practically all the exhibits there was of course directly commercial but one collection appealed almost entirely by its technical features. This was a series of about two hundred models, all of a working character and gathered from various sections of the German engineering industry. It was arranged by the Ausschuss für Wirtschaftliche Fertigung, Berlin, and the writer is informed that this organization has decided to photograph all the exhibits and provide descriptions in German and also, it would seem, in English in book form.

Since the war it has been the policy of the Machine Tool Trades Association of Great Britain to ban the exhibition of German machine tools, though machine tools of other countries have been admitted at the London show. Apparently arising primarily out of this situation a new association, the Machinery (Machine Tool and Woodworking) Importers' Association of Great Britain, has been formed. As may be expected, the members of the council are interested very largely in the importation of German machinery, but the association is clearly not intended to be limited in this way. One possible effect is that at engineering exhibitions of international character, held periodically in London and elsewhere, a definitely organized attempt may be made to display German and other imported machine tools.

Machine Tool Makers to Develop Trade in India

A representative group of American machine tool and supply manufacturers has arranged for co-operative effort in India. The members of the group acting as individuals have appointed C. Warren-Boulton, of Calcutta, their exclusive representative in India for a term of years. Mr. Warren-Boulton after spending several months in this country at the works of the companies he will represent, is now on his way to India.

The list of companies concerned are: Niles-Bement-Pond Co., Pratt & Whitney Co., Warner & Swasey Co., Yates-American Co., L. S. Starrett Co., E. W. Bliss Co., Kearney & Trecker Corporation, Barnes Drill Co., Monarch Machine Co., Simonds Saw & Steel Co., Landis Machine Co., Landis Tool Co., Cushman Chuck Co., Osborn Mfg. Co., Morton Mfg. Co., Cincinnati Shaper Co., J. G. Blount Co., J. H. Williams & Co., C. C. Bradley & Son, Inc., Jacobs Manufacturing Co., Racine Tool & Machine Co., Adams Co., W. W. Sly Manufacturing Co., Standard Tool Co., National Acme Co. and Gallmeyer & Livingston Co. Mr. Warren-Boulton will be in a position to take care of the requirements of railways and industrial establishments for machine tools and allied supplies by offering modern American equipment. A co-operative endeavor of this nature organized to make American equipment available to customers in a foreign country through direct representation on the ground, is a novel step and far reaching results are expected.

While the group is not definitely and finally closed, it is not the intention to expand it materially. Further information may be obtained by non-competing manufacturers upon application to R. M. Derby, manager, Foreign Department, Niles-Bement-Pond Co. and Pratt & Whitney Co., 111 Broadway, New York City, or to C. J. Stilwell, sales manager, the Warner & Swasey Co., Cleveland, Ohio.

Dr. Swanson Talks to Screw Machine Products Association

Dr. Arthur E. Swanson of the Swanson Ogilvie Co., Chicago, addressed members of the Screw Machine Products Association at their meeting held in Chicago, May 17, the subject of his talk being "The Importance of Costs to Business." Dr. Swanson pointed out that the primary objective of business is profit and that service is one of the most important instruments from which profits can be achieved.

Six reasons why costs are often overlooked were mentioned: (1) Many fail to comprehend the significance of costs; (2) concerns often start on a small basis and are not confronted with the problem of overhead expenses, but as business increases, they disregard too freely the importance of costs; (3) cost finding is not simple; (4) costs are sometimes overlooked due to some bad experience in the past; (5) getting costs cost money; and (6) even when costs are figured, there is a certain helplessness due to competition by concerns that operate regardless of costs, thus causing the disregard for what is known to be right.

In commenting on the last situation,

Dr. Swanson outlined how the evil should be corrected, in three ways. First, if an industry has a number of members who do not know their costs, propaganda should be spread to cause them to appreciate the value of costs. Second, members should be educated by trained representatives on how to arrive at correct costs. Third, cost classifications should be made as uniform as possible, so that everyone will talk the same language. Dr. Swanson's closing remarks dealt with the elimination of direct costs, the application of burden, and the problem of handling normal production.

David Bell, of the David Bell Company, Buffalo, N. Y., and president of the association, was chairman of the meeting. The balance of the session was devoted to miscellaneous business of the association.

Boston & Maine R.R. to Centralize Repair Work at Keene

The Boston & Maine car shops at Keene, N. H., are being enlarged and improved to take care of all maintenance work which is being concentrated at this point. Gasoline rail cars are to be repaired in this shop, and wrecking cranes, locomotive hoists, ditchers, rail unloaders, pile drivers and ballast spreaders from all over the system. To handle this work the machine shop section is being re-equipped with new tools and appliances, and new tracks are being laid. New hoists of large capacity are also being installed to handle the heavy maintenance-of-way equipment.

Work that has been done in the past at these shops will be continued, such as general blacksmith repairs and maintenance work on car trucks. Some of the old engine pits, which were used by the Cheshire Railroad and filled in about twenty years ago, are being excavated again and will be used in connection with the new plant.

S.A.E. to Discuss Gear Production at Summer Session

Two important papers on gear production feature the Summer meeting of the Society of Automotive Engineers to be held at the Chateau Frontenac, in Quebec, June 26 to 29. One paper, entitled "Ground Gear Production and Gear Box Design" will be read by H. L. F. Orcutt, of the Gear Grinding Co., Ltd., of England. The other, entitled "A New Method of Cutting Gears," is by Charles H. Logue and R. B. Fehr, of the Copland Gear Lapping Syndicate. Both papers will be presented at the afternoon session on June 27, Wednesday.

At the opening session to be held in the evening, June 26, W. G. Wall, president of the society, will preside and will deliver the principal address. He will be followed by Major E. G. E. Beaumont, president of the Institution of Automobile Engineers, of London, and Norman Shidle, of the Chilton Class Journal Co., who will speak about "The Engineer as a Business Man."

At other sessions, technical problems in the design of automobile and airplane parts and units will be discussed.

Ford Gets Franklin Institute Award

Henry Ford was among a group of fifteen men prominent in invention and scientific discovery who received medals from the Franklin Institute, of Philadelphia, at its annual medal meeting on May 16. Mr. Ford received the Elliott Cresson Medal in recognition of his development of mass production and for his leadership in industry. Charles L. Lawrence received a similar award for his development of the Wright air-cooled engine. The Franklin Medal, the highest award, went to Charles F. Brush for his invention of the electric storage battery.

Westinghouse Report

As shown by the annual report of the Westinghouse Electric & Manufacturing Co., the sales of the company for the year ending March 31, 1928, were about $175,000,000; the net manufacturing profit was $14,000,000; the net income available for dividends was $15,600,000; and the earnings per share of stock (preferred and common) were $6.57, or 13.4 per cent. Dividends were paid, however, on both stocks at the rate of 8 per cent. These figures indicate a slight decrease in business as compared with the previous year.

Purchasing Agents Want Basic Facts

The great need for basic facts around which purchasing practices may be organized was stressed by several speakers at a meeting of the National Association of Purchasing Agents, held recently in New York. After a general discussion of the status of the ethics and economics of purchasing, it was agreed that the whole situation is concerned with a few fundamental principles, and the improvement of the situation awaits upon the discussion and acceptance of these principles by executives of industry. These principles have been discussed in recent articles in these pages.

Among the speakers were: E. F. DuBrul, general manager of the National Machine Tool Builders' Association; W. W. Nichols, president of the Machinery Builders' Society; E. J. Mehren, vice-president, McGraw-Hill Publishing Co.; Earl Whitehorne, commercial editor, *Electrical World;* and N. A. Wolcott, president, National Electrical Manufacturers' Association.

Reliable Statistics on Employment Lacking

Magnus W. Alexander Analyzes Economic Situation for Industrial Conference Board

NO ADEQUATE information exists on which to base reliable estimates of unemployment in the United States was the conclusion of President Magnus W. Alexander of the National Industrial Conference Board in his opening address at the all-day meeting of the board in New York on May 17. He led up to this statement by pointing out the deplorable fallacies existing in the estimates made by others during the last few months. These estimates were greatly exaggerated and the wage level remains practically constant.

The 200 executives at the all-day session of the board included leaders of industry, transportation, mining, commerce and finance, employing several hundred thousand persons and the heads of national and state associations comprising more than 50,000 industrial concerns.

Virgil Jordan, chief economist of the Industrial Conference Board, declared that foreign debts to the United States would never literally be paid back, but would become permanent investments. One consequence of such international enterprise, he said, was the closer relationship between the Federal Reserve System and the control banks of Europe.

Other speakers were Gilbert H. Montague, an attorney; William J. Schultz, economist; Charles H. Herty, adviser to the Chemical Foundation; Kenneth H. Condit, editor of the *American Machinist*, and Herbert F. Perkins, vice-president of the International Harvester Company.

Loyall A. Osborne, president of the Westinghouse Electric International Co., was re-elected chairman of the Industrial Conference Board and Fred I. Kent, director of the Bankers Trust Company, was re-elected treasurer.

It was announced during the evening that Charles Evans Hughes, who was a guest at the dinner, had been elected a deputy counselor of the board. Mr. Hughes acknowledged the honor in a brief talk at the dinner table. The other speakers were Charles Nagel, of St. Louis, former Secretary of Commerce and Labor; John C. Merriam, president of the Carnegie Institution at Washington, and Professor Michael I. Pupin of Columbia University. Loyall A. Osborne, chairman of the board, acted as toastmaster.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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A WELL-KNOWN commentator on business says that "waves of speculation like the present one cannot be killed off; they have to commit suicide." The history of the present and of other speculative manias all the way back to Holland's tulip craze in the 17th century testifies that this is true. When speculation has taken enough rope it eventually hangs itself. And as the self-destruction may have repercussions of commercial importance, most business men are naturally watching closely for signs that it is beginning.

Therefore, the sharp break in prices that occurred on the New York Stock Exchange last Wednesday, in a turnover of almost 5,000,000 shares, caused some tremors along the country's business backbone. If it proves to have been a passing weakness, speculative fervor may be all the more intense when buying is renewed. But it was followed on Friday by the expected advance in the rediscount rate of the New York Federal Reserve Bank to 4½ per cent, which had been postponed for several weeks presumably because the directors sought to make it at a time when it would really be effective. It is true that such a wave of speculation "cannot be killed off," as has been demonstrated by the futility of earlier Federal Reserve efforts to halt it; but the advance in the rate, the earmarking of another $50,000,000 of gold for export, and the continued sale of government securities, which subtracts credit from the market, may be likened to raising the price and reducing the ration of the food and water on which the body of speculation depends for its sustenance. Thereby the process of suicide is facilitated.

Time loans against securities in New York last week commanded 5¼ per cent interest, having advanced from 4½ per cent since the first of the year. Meanwhile the leading stocks are selling at prices which yield on the average no more than 3 per cent, if that. This means that those who are so freely borrowing money in order to buy or carry stocks—to a total of some five billion dollars on the New York Stock Exchange alone—are receiving less in dividends than they pay out in interest. Even if they are content with this, in the belief that continued advances in prices will overcome the difference, it must be realized that the advances themselves make the spread even wider, for they both reduce the dividend yield and make money dearer by increasing the necessity for borrowing. This is a trend that will soon lead into financial topsy-turvydom, if indeed it is not there already; and wise men are realizing, as they have for some time, that while the duration of speculative activity which persists under such conditions cannot be foretold, its end is probably not in the very distant future.

WHAT'S DOING IN INDUSTRY

NEW YORK is the only center reporting a decline in machine tool orders in the past week, but even there a spirit of optimism prevails due to the fact that much business is in the air. A reluctance on the part of buyers to place orders for needed equipment is chiefly responsible for this condition. Similar sales resistance is noted in the Cleveland market and in New England, where steady conditions prevail with a good volume of orders. Inquiries are also holding up well there and in Cincinnati and Detroit, while in Chicago the tone and volume of inquiries are improving.

RAILROAD buying is good in Chicago, poor in New York, more active in New England, and is expected to pick up in Milwaukee. About two-thirds of the orders for tools placed in Rockford are from automotive shops, and naturally this class of customer furnishes the bulk of trade in Detroit, where present boom times are expected to continue for some time. In Milwaukee this type of buying is better than anticipated, while in Philadelphia orders from automobile manufacturers are serving to keep business in machine tools at a satisfactory level.

AERONAUTICAL plants are also busy. The Wright interests have been buying for some time, and this week finds the Curtiss company a heavy purchaser of equipment. In general, manufacturers of tractors, farm machinery and contractors' supplies and equipment are all busy, and hence active buyers. Electric equipment manufacturers are also well occupied.

During the past week aeronautic securities have been the most fashionable as they have the strongest appeal for the excited imagination of the public. It is impossible to say in what quarter the next speculative outbreak will occur, but it is in order to note that radio has already had its fling and unless the scientists and inventors soon bring forth some other marvel for the future, there will be nothing left for the speculative imagination to feed upon.

Therefore it is not to be wondered that the events of the week have had a somewhat sobering effect upon business. It is worth noting that our foreign trade statement for April shows that our exports and imports of merchandise were both smaller than last year. We also appear to be running behind 1927 in the distribution of merchandise. Car loadings for the week ending May 5th are 5 per cent less than a year ago. It is true, as many commentators point out, that most of this decrease is in coal, but after all, slackness in the coal industry is just as depressing as in any other.

The Federal Reserve Board reports that manufacturing output in March exceeded that of any other month for which records are available, representing a gain of 20 per cent since December. Less is heard about unemployment and if the falling off in applications for office work, reported by the New York agencies, is any criterion, it has been reduced materially since the winter. But reports from the industrial centers suggest a slight decline in activity. Some of the automobile factories are less busy than in March and April, as they wait for retail buyers to absorb some of the stocks accumulated in dealers' hands. A demand that will quickly use up these stocks is looked for as soon as the expectation of a repeal of the tax on automobiles in the pending revenue measure is either realized or removed. Meanwhile General Motors' sales in April are reported to have been the largest of any month in the corporation's history by a wide margin.

The iron and steel industry apparently faces some curtailment of production, as the decline in the unfilled orders of the U. S. Steel Corporation exemplifies a reduction in "mill backlogs" to which output will have to be adjusted. Textile manufacturing also has dropped to lower levels, from which it is unlikely to recover much in the near future. Building in April broke all records, it is reported by the F. W. Dodge Corp., but new work planned during the month was 6 per cent less than in March, and 4 per cent less than in April a year ago.

The pre-nomination campaign for the presidency does not appear to have caused any misgivings, and as none of the prospective candidates is a radical, it seems unlikely that the result of the election will cause any unsettlement.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future.

CLEVELAND

Steadiness describes the condition of the local machinery and machine tool market. Sales for the first half of May equaled that of the last half of April. Although the aggregate number of orders closed was less, the total value was just as great. Orders closed included several large lists. A comparison for the year to date shows a gain over last year.

There is a slight slackening, however, in some lines. For the first time in many months a falling off in orders for automatics is noted. With the summer months at hand a general decline is expected.

Railroads and the automobile industry are the leading buyers. Inquiries are satisfactory in number but prospective purchasers are very slow in closing.

Export business has increased recently. Several fair-sized lists for concerns in France and England were closed.

DETROIT

The condition of the machinery and machine tool market here not only continues to be very good but it also gives evidence more and more that it will remain good for some months to come.

Right now it is steady and firm. There are numerous inquiries and many orders. All of the automotive plants are working at capacity. Ford is still going ahead, although not as rapidly as many people believed he would. In general, however there is a very fine feeling of optimism and it is generally believed that Ford will reach a production rate of 4,000 or 5,000 cars a day before the end of the year.

So brisk is the business here that it was necessary, one day last week, for a member of one machinery company to take an airplane trip to Cleveland to get an order through.

The Continental Motors Corporation has taken over the production and selling rights of the "Hydro Check" shock absorber and will produce the device in its Detroit and Muskegon plants. It is believed the company will ultimately turn out 6,000 sets a day.

Employment is still going ahead here.

CINCINNATI

The great majority of the machine tool manufacturers in the Cincinnati district report that business showed an improvement in the past week and none reports a falling off of orders in the period. When books are closed for the month, it is thought, they will show that the trade as a whole has made a gain over the previous month. Statements made by manufacturers vary, some saying that the demand is fairly good, others stating that it is good and a few others stating that it is very good.

Selling agents report that they feel very much encouraged because of the increased volume of sales they have made in the past week. They express the opinion that gradually the demand will increase, basing this forecast on the fact that there an increasing activity in the demand in the metal trades in local and adjacent territory.

Orders came from all sections of the country and were well diversified in the matters of sizes and types, but were largely for single items. Concerns in the automotive field and allied industries bought more than in the previous week, their purchases being largely confined to replacements and single tools, some of the latter being for try-out purposes. Railroad buying was confined also to orders for single units.

A good volume of inquiries came in during the week, from all sections of the country and for all kinds of tools. Quite a number came from the automotive field.

BUFFALO

The spotty condition in the machine tool trade previously reported still continues in the Buffalo district. A few report good business but most of this is for orders which have been hanging fire for some time—in some cases for several months. Most of the reports however are encouraging. There is a feeling in some quarters that there will be a greater buying movement next month before the summer vacation season starts. Purchase was announced a few days ago of a large amount of equipment for the Buffalo plant of the Curtiss Aeroplane and Motor Co. for the purpose of increasing manufacturing activities here.

In the electrical field of industrial equipment orders continue small but total into a fair volume. No change seems to be immediately in sight. There is the usual seasonal activity in the contractors' equipment field.

CHICAGO

Business in machine tools during the last ten days has somewhat more than held its own. Reports from several sources indicate that sales thus far in May are a shade ahead of those for the first two weeks of April. Railroad buying is showing improvement, the Burlington, St. Paul and Union Pacific having each placed several orders. The Santa Fe, which is said to have made practically no move during the last month toward buying against its lists, is expected to close on some of its big items within a short time.

Inquiries are coming in more freely than for the last few weeks, and are for a wide diversity of equipment. Among local inquirers, the Chicago Board of Education is again in the market, equipment of a varied character being needed for the Washington Continuation and Trade School and the Sheldon Continuation School.

Manufacturers of farm machinery and tractors continue to buy freely, grinding machines being one of the leading items called for. An optimistic feeling pervades the machinery trade, and forecasts are to the effect that business will continue on a good level at least until the end of June, when the usual seasonal slackness may be expected.

PHILADELPHIA

The award of contracts for shop equipment for the new Broad Street subway shops was the outstanding feature in the Philadelphia machinery and machine tool market during the last two weeks. The amount of the total award was $180,524, the list including lathes, milling machinery, shapers, drills, drill presses, grinders, threading machines, anvils, cutters, hoists and other equipment. Delivery is to start by September 1, when the new city-owned line will be ready for operation. Bids were received some weeks ago by the Department of City Transit, but, owing to the close bidding and the technical features of the schedules and specifications, the award was delayed.

Business in other machinery lines was reported quiet, except for some orders from the automotive industry. Some of the firms that produce equipment for this trade were in receipt of some orders, and some inquiries from general industrial lines served to bring the situation in this market to what was regarded by many as a satisfactory level. Dealers in used tools and machinery reported a dull period with an absence of substantial inquiries.

NEW ENGLAND

The tone of the New England market is unchanged. Machinery and machine tool inquiries hold up well with placements favoring single items. Despite the absence of lists numbering a dozen or more tools the market has, on the whole, developed a steadiness that portends at least a normal level of business for some time to come. New England railroads are displaying more activity.

The New York, New Haven & Hartford Railroad has awarded contracts for an electric cinder plant and five sand towers for electric locomotives. This road and the Boston & Albany is in the market for five or six tools. The Boston & Maine is planning shop changes involving replacements.

Machine shops and large garages are taking the bulk of the used and rebuilt equipment sold in this section, dealers report, with a good volume of sales to small parts manufacturers. Sales competition in this line remains extremely keen, and salesmen report the hardest kind of plugging to book orders.

In the main the market seems to be slightly retarded by a provoking consistency in allowing prospective business to hang fire. A more urgent need for proposed outstanding requirements would certainly make a remarkable difference. Builders and dealers, however, with an occasional exception, report the first three weeks of May as satisfactory.

MILWAUKEE

Business in metalworking equipment so far in May has been of sufficient volume to justify the expectation that the month will close in a most satisfactory manner. Some companies are ahead of last year, while others say they will be satisfied to keep even. The situation, on the whole, is showing improvement, and however slight this may be in some instances, it is regarded as a good sign. Most shops are comfortably situated with respect to orders, and some difficulty is being experienced when skilled machinists are needed to fill places promptly.

The call for equipment from automobile factories, while not of the customary volume, nevertheless is said to be better than had been expected earlier, and with the trade in a flourishing condition as the result of good absorption of output, the tool trade is looking forward to a continuance of a moderate demand. Manufacturers of tractors and of gas engines for industrial equipment continue to enjoy active business and in some cases have found it necessary to step up capacity. There is, however, a certain, definite conservatism about all expansion, lest this might develop into over-capacity at a later date. Usually larger output is effected by

the replacement of machinery with the latest designs of high-production tools rather than by enlarging plant and equipment.

Given an improved demand from railroads, which now seems in prospect, the tool trade views the future with a good deal of optimism. Active railroad buying has been so long deferred, however, that most makers decline to express any predictions until the demand is in actual development.

Reports from Rockford indicate that on the average machine tool building shops are working about 92 per cent of full capacity. In more than one case they are operating 10 to 15 per cent over capacity, and in one instance as much as 25 per cent. About two-thirds of the orders received have been from automotive plants.

NEW YORK

A noticeable let up in business activity is noted as far as machine tool dealers in the New York market are concerned. Both orders and inquiries have fallen off in the past week according to several representative dealers handling well-established lines, but small machines continue to sell in fair volume. Little pessimism is felt, however, due to the fact that much business is in the air, but, as reported from many other centers, there is a timidity on the part of buyers to place orders for needed equipment. Because of heavy sales in the earlier part of the month, business in May will probably not show a noticeable decline.

This hesitancy is particularly true of the railroads, the requirements of which are known to be voluminous, but the orders from which are few and far between. For companies handling railroad shop tools, New York has been a poor market for some time, with little prospect of a change in the near future, although sales to other parts of the country have been fair for the past few months. Chicago is the chief center of activity at present. It is understood that the Chesapeake & Ohio R.R. has out a list for several machine tools. Among the railroad tools sold in the past week were: a 48-in. car-wheel borer, a combination journal-turning and axle lathe, a car-wheel lathe, a 24-in. crank slotter, and a 30-in. "Timesaver" lathe, all from the Niles Tool Works Company.

The chief buyer in the market for the past few weeks has been the General Electric Co. A list issued in the past fortnight calls for eight lathes, a tool room grinder, a milling machine, and a cylindrical grinder. Another large list, issued from Washington, is for equipment for the Panama Canal shops. Bids are to open on May 28. A large assortment of machine tools is included, as well as miscellaneous supplies and office equipment.

A.S.M.E. to Hold Aeronautical Meeting in Detroit

The aeronautic division of the American Society of Mechanical Engineers is planning to hold a national meeting in Detroit on June 28 to 30. The technical sessions will be held at the Book-Cadillac Hotel, and on the first day the subjects discussed will be transportation, and power plants and woods used in airplane construction. At the dinner on the 28th, Alexander Dow, president of the A.S.M.E., will preside, and it is expected that aviators and balloonists from many nations will be present, among them Capt. George H. Wilkins, the Arctic flyer.

On the second morning there will be simultaneous sessions on airplane design and on airways. The afternoon will be devoted to the inspection of plants, while the evening session will be devoted to general aeronautics topics. The last day will be spent at the Ford Airport, where the reliability races will start.

Mill Supply Associations to Combine

Three committees, each representing their respective associations, are to get together in the coming month and work out a plan for a single organization to replace the present three: the American Supply and Machinery Manufacturers' Association, the National Supply and Machinery Distributers' Association, and the Southern Supply and Machinery Dealers' Association. These committees were authorized at a joint meeting of the associations held in Nashville, Tenn., on May 15 to 17. Another feature of the meeting was an address by Charles J. Graham, of Pittsburgh, president of the Bolt, Nut and Rivet Manufacturers' Association, on the relation of his association to the mill supply field.

Newly elected officers of the American association are: president, Dixon Williams, Chicago Nipple Manufacturing Co.; first vice-president, S. P. Browning, Ohio Valley Pulley Works, Inc.; second vice-president, C. O. Drayton, Drayton & Knight Co.; third vice-president, B. F. Reuther, Mechanical Rubber Co. Officers of the National association are: president, E. P. Welles, Chas. H. Besly & Co.; first vice-president, H. H. Kuhn, Hardware & Supply Co.; second vice-president, H. E. Ruhf, Cleveland Tool & Supply Co.

The following officers were elected by the Southern association: president, W. W. Doe, Alabama Machinery and Supply Co.; first vice-president, D. D. Peden, Peden Iron & Steel Co.; second vice-president, C. J. Salm, Dixie Mill Supply Company.

Secretary Warner's Book Is Awarded Medal by Aero Club of France

The Aero Club of France has awarded its medal for the best technical work on aeronautical engineering appearing in 1927 to the Honorable Edward P. Warner, Assistant Secretary of the Navy for Aeronautics, for his "Airplane Design-Aero-Dynamics."

This book was published by the McGraw-Hill Book Co., New York, in August of 1927. It occasioned immediate interest on the part of aeronautical engineers here and abroad. In three months the first large printing was completely exhausted and another larger printing was isued.

Secretary Warner is a member of the Society of Automotive Engineers, Associate Fellow of the Royal Aeronautical Society and professor of aeronautical engineering at Massachusetts Institute of Technology. In July, 1926, he was appointed Assistant Secretary of the Navy for Aeronautics.

World Economic Conditions Improved

The International Chamber of Commerce with headquarters in Paris has just issued a review of world economic conditions in 1927. The Chamber finds world economic conditions in general improved over 1926.

As a whole, world production was good in agriculture and, generally speaking, fairly satisfactory in industry where the application of rationalization developed as did the tendency toward national and international agreements. International trade displayed greater activity than in 1926, notwithstanding the fact that prices fell slightly almost everywhere. Also, the world of finance recorded important progress toward the restoration of public finances, the stabilization of national currencies, and co-operation between banks of issue.

The movement of world industrial output in 1927 did not display any uniform tendency. In fact, although in certain countries the quantity of manufactured products increased considerably, in other countries systems of depression were discernible, due in part to temporary influences. Taken as a whole, European industry showed increased activity.

The Chamber reports that industrial cartels, price cartels, and territorial cartels between the principal allied industries of Europe showed further development in 1927, and have begun to extend to countries that previously showed a certain distrust of such combinations.

Industry Suggests Planks for Party Platforms

Suggestions for planks which manufacturers desire in both Republican and Democratic platforms were adopted by the committee on American industry of the National Association of Manufacturers held in New York recently. The fifty members of the committee, representing industry in every state, approved planks favoring protective tariff, restricted immigration, flood control, extension of aid to farmers, the Federal Reserve Bank and a privately owned American merchant marine. In its "Government and Business" plank the committee urged "more reliance upon private energy and character and less upon public law and appropriations."

Intensive Shop Practice Courses at Purdue

Announcement has been made of intensive summer courses in shop practice at Purdue University, Lafayette, Ind., from June 14 to August 15, under the direction of the department of practical mechanics of the School of Engineering. Course S 61 is on drafting; Course S 71 on job shop methods, including blacksmith work, installation and maintenance of machinery, and carpentry and other wood work; Course

S 73 on pattern making; and Course S 74 on forging, welding and heat-treating. The content of the last course will be planned for skilled workmen. It includes practice in forging by hand or power, gas or electric welding and cutting, and the heat-treatment of iron and steel. Furnace design and operation will also be studied.

Course S 75 is on toolmaking. It includes in addition to jig and fixture work, regular machine tool operation, as well as tooling up for particular jobs. The time for each course is 40 hr. per week.

Foundrymen Meet in Philadelphia

During the week of May 14 to 18, the American Foundrymen's Association held its annual meeting at Philadelphia. Some of the problems discussed included steel founding and metallurgy, cast-iron founding and metallurgy, malleable iron, brass founding, foundry management, sand control, apprentice training, and material handling. There was also presented a cupola operation course. S. P. Johnson, vice-president and general manager of the S. Obermayer Co., Chicago, was elected president of the association for the coming year. S. Wells Utley, retiring president, was elected to serve on the directorate. Fred Erb, president of the Erb-Joyce Co., of Detroit, was elected vice-president.

Personals

THOMAS G. NEW has been elected president of the Acme Wire Co., New Haven, Conn., to succeed V. M. Tyler, resigned.

REGINALD G. MATTHEWS has been appointed assistant chief of the industrial machinery division of the Department of Commerce.

R. W. BAIRD, Milwaukee banker, has been elected a director of the Chain Belt Co. to fill the vacancy caused by the death of H. O. Seymour.

J. V. MOORE, formerly with the Simonds Saw & Steel Co., is now representing the Billings & Spencer Co., of Hartford, Conn., in Pennsylvania, Delaware and New Jersey, with headquarters at the Leister House, Huntingdon, Pa.

H. A. STILLWELL, who has for the past 38 years been Birmingham manager of Charles Churchill & Co., Ltd., England, has retired, but will act in an advisory capacity. He is succeeded as manager by H. McCall.

ROBERT M. DERBY, manager of the foreign department, Niles-Bement-Pond Co. and Pratt & Whitney Co., New York, sailed for Europe on May 11. He will be away for several months. Before leaving, Mr. Derby was tendered a luncheon in recognition of his 25 years' service with the organization.

C. H. BURR, treasurer of SKF Industries, Inc., has been appointed to the board of directors of the Motor & Accessory Manufacturers Association, and was also made secretary and assistant treasurer of the association to fill the vacancy of A. H. D. Altree, resigned.

E. D. PIKE was recently promoted to the position of manager of the San Francisco sales office of the Wagner Electric Corporation, of St. Louis. He has been with the organization for 26 years and was formerly in charge of service on the Coast.

NORMAN DODGE will succeed his father, Philip T. Dodge, as president of the Mergenthaler Linotype Co., of Brooklyn, N. Y. Mr. Dodge, Sr., resigned after 37 years in office because of ill health. He will become chairman of the board, a newly created position. His former position on the executive committee will be filled by Frederic D. McKenney. The junior Mr. Dodge has been vice-president and general manager of the company.

Obituaries

GEORGE A. EDE, founder of the Cobden Machine Works, Cobden, Ill., died recently.

LOUIS STOCK, secretary and treasurer of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, died on May 12 at the age of 67. He has been connected with the company for the past six years.

SANFORD B. BELDEN, vice-president of the Jeffrey Manufacturing Co., of Columbus, Ohio, died at the age of 56 in the Chatham Hotel, New York, May 14, from an attack of heart trouble. He was on a business trip to New York when taken ill. He had been identified with the Jeffrey Manufacturing Co. for 32 years, and for the last 18 years served as vice-president. Prior to his election to the vice-presidency he was manager of the Pittsburgh branch of the company.

Dr. Felix Deutsch, president of the General Electric Co. of Germany, died in Berlin on May 19 at the age of 70. He was one of Germany's richest men, and has been prominently identified with the development of applied electricity for the past 45 years. Dr. Deutsch was a world traveler, and his diplomacy in dealing with foreign powers contributed to a large part of his success. Since the war he has done much to stabilize not only his own company, but also industrial conditions in Germany generally. He was a director of more than forty executive committees.

Business Items

The Cummins Engine Co. of Columbus, Ind., has increased its preferred stock to $340,000.

The Farmer Lubrication Systems, Inc., has been reorganized under the name Lubrication Devices, Inc., and is now located in Battle Creek, Mich.

Announcement is made by the Poldi Steel Co. of America that its New York office and warehouse are now located at 245 to 247 West 18th Street.

The Foote Bros. Gear & Machine Co., of Chicago, has appointed Woodbury and Wheeler, 55 2nd St., Portland, Ore., as representatives.

The H. D. Smith Co., Southington, Conn., one of the oldest drop forging companies in the country, is voluntarily bankrupt and is to be sold at public auction.

The Mills-Lipton Co., 1160 Market St., Chattanooga, Tenn., was recently appointed representative of the South Bend Lathe Works, of South Bend, Indiana.

The Barnes Foundry Co., Cleveland, has moved from its former location at 3181 W. 104th St. to the plant of the Pattern Engineering Co., 4007 Detroit Ave., which it has bought.

The International Silver Co., Meriden, Conn., has purchased the hollow ware business of E. C. Webster & Sons, Inc., Brooklyn, N. Y., and will manufacture this product at Meriden.

Suit has been filed in circuit court at Brazil, Ind., by Mrs. Nancy McNutt against the Brazil Machine and Foundry Co. of that city for a receiver. She is the principal stockholder.

The Marshalltown Heater Co., Marshalltown, Ia., has been sold to the Union Furnace Co., of Columbus, Ohio. The new owners plan to continue the same Marshalltown line. The transfer does not affect the Marshalltown Manufacturing Co.

Reopening of the Indianapolis assembly plant of the Ford Motor Co. will take place in about three or four weeks, according to an announcement of George Steinmetz, manager. Workmen have been installing new equipment and revamping the old equipment.

Letters of incorporation have been granted to Universal Tool & Die Works, 516 N. La Salle St., Chicago. The company will manufacture and deal in metal specialties, tools, dies and jigs. Capital $50,000. The incorporators are E. F. T. Lundquist, Peter J. Metz and Carl H. Lundquist.

The Olsen Manufacturing Co., Kenosha, Wis., has been formed to make dies, jigs and fixtures and to manufacture automotive parts. The company has taken over the former Winter truck plant. H. P. Olsen, Milwaukee, Lester S. Olsen and R. E. Bussian, Racine, formed the company.

The Marine Hardware Co., South Portland, Me., and the Union Iron Works, Bangor, Me., have merged and organized under the name the Maine Steel Products Co. Expansion is planned for the manufacture of steel products including Sargent snow plows.

Forthcoming Meetings

Associated Machine Tool Dealers. Annual spring meeting, May 23 to 26, at Granville, Ohio. E. P. Essley, secretary, 551 W. Washington Blvd., Chicago.

National Association of Foremen. Fifth annual convention, May 25 and 26, at Canton, Ohio. E. H. Tingley, secretary, 1249 Unity Bank Building, Dayton, Ohio.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

American Railway Association. Schedule of sectional meetings: Division V, mechanical, June 20 to 27, Atlantic City, N. J.; Division VI, Purchases and Stores, June 20 to 22, Atlantic City, N. J.; Division VII, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Gear Manufacturers Association. Semi-annual meeting, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

IRON prices tend downward; steel quotations hold at current levels for the principal materials. Steel mill operations are at 84 per cent of capacity as against 81 per cent a year ago. The practice of buying for immediate requirements again prevails in the steel market, following a six-months period of rising prices with consequent purchasing for future delivery. Fabricated structural, automotive and agricultural implement steel is in active demand, with oil country goods and railway material moving more slowly than at this time last year. Galvanized steel sheets are off 10c. per 100 lb. at Pittsburgh mills. Imported wiping cloths gained about 1c. per lb., compared with last week's prices.

(All prices as of May 18, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.50	3.25	3.90*
No. 12	2.05@2.15	3.55	3.30	3.95*
No. 14	2.15@2.20	3.60	3.35	4.00*
No. 16	2.25@2.30	3.70	3.45	4.10*
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.55	4.00
No. 22	2.85@2.95	3.90	3.70	4.15
No. 24	2.90@3.00	3.95	3.75	4.20
No. 26	3.00@3.10	4.05	3.85	4.30
No. 28	3.15@3.25	4.20	4.00	4.45
Galvanized				
No. 10	2.90@2.95	4.10	3.80	4.25
Nos. 12 to 14	3.00@3.05	4.20	3.90	4.35
No. 16	3.10@3.15	4.30	4.00	4.45
No. 18	3.25@3.30	4.45	4.15	4.60
No. 20	3.40@3.45	4.60	4.35	4.75
No. 22	3.45@3.50	4.65	4.40	4.80
No. 24	3.60@3.65	4.80	4.50	4.95
No. 26	3.85@3.90	5.05	4.75	5.20
No. 28	4.10@4.15	5.30	5.00	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in., steel, butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in., steel, lap welded	48%	35%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
¾	.58½	2.875	2.469	.203
1	.76½	3.5	3.068	.216
1¼	.92	4.0	3.548	.226
1½	1.09	4.5	4.026	.237
2	1.27	5.0	4.506	.247
2½	1.48	5.563	5.047	.258
3	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	Thickness—B.w.g. and Fractions	Outside Diameter in Inches—⅛	¼	⅜	½	¾	1	1⅛	1¼
		Price per Foot							
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049″	18	.17	.18	.19	.20	.21	.23	.25	
.065″	16	.19	.20	.21	.22	.23	.25	.27	
.083″	14	.20	.22	.23	.24	.25	.27	.29	
.095″	13	.21	.23	.25	.26	.27	.29	.31	
.109″	12	.22	.24	.26	.27	.28	.30	.32	
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33	
.134″	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; 1/8, 7.85c.; 5/32 to ½ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.00
Tin, straits, pigs, New York			53.50
Lead, pigs, E. St. Louis	6.00	New York	7.00
Zinc, slabs, E. St. Louis	6.10	New York	7.00

	New York	Cleveland	Chicago
Antimony, slabs	13.50	13.25	14.25*
Copper sheets, base	23.00	23.00	23.00
Copper wire, base	19.50	19.62½	16.00*
Copper bars, base	21.50	21.50	22.00
Copper tubing, base	24.75	24.50	24.50
Brass sheets, high, base	19.00	18.75	18.75
Brass tubing, high, base	23.87½	23.62½	23.62½
Brass rods, high, base	16.75	16.50	16.50
Brass wire, high, base	19.62½	19.50	19.25

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	22½@24	24.30
Zinc sheets (casks)	9½@10	10.75	9.36
Solder (strictly)	33.75	32.50	31@34
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			70.75
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.00
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound for carloads, f. o. b.:

	New York	Cleveland	Chicago
Crucible copper	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire	11.50 @12.37½	10.75	10.75@11.25
Copper, light, and bottoms	10.25 @10.75	9.50	9.50@10.00
Heavy lead	5.00 @ 5.25	5.25	4.25@ 4.75
Tea lead	3.75 @ 4.00	3.75	3.25@ 3.75
Brass, heavy, yellow	7.12½@ 7.37½	7.25	7.00@ 7.50
Brass, heavy, red	9.25 @ 9.75	9.75	9.00@ 9.25
Brass, light	5.50 @ 6.00	5.75	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.25@ 7.75
Zinc	3.25 @ 3.50	3.25	2.75@ 3.25

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.16@.17½	38.00 per M	.17
Sal soda, per lb	.02	.02	.02¾
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 1 to 4 bbl. lots	83¼	84	.78
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade	45%	50–10%	50%
Second grade	50%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.165	.165	.1587½
Solder (½ and ½)	per lb.	.3375	.34	.41
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.30	.30	.33
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.40	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
†Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.60@2.75
Coke, prompt foundry, per net ton	Connellsville,		3.75@4.50
White lead, dry or in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mich., Utica—Packard Motor Car Co., East Grand Blvd., Detroit—machinery and equipment for proposed 1 story, 67 x 112 ft. repair shop here. Estimated cost $40,000.

N. J., New Brunswick—Bd. of Education, Livingston Ave.—will receive bids until May 28 for machinery and equipment including drill presses, shapers, etc. for School No. 1 on Easton Ave.

N. Y., New York — New York Central R.R. Co., 466 Lexington Ave., C. S. White, Purch. Agt.—24 in. lathe, turret lathe, shaper, etc.

O., Alkali—Diamond Alkali Co., First and Second National Bank Bldg., Pittsburgh, Pa.—15 ton, 2 motor, 37 ft. span overhead electric crane.

O., Cleveland—Case School of Applied Science, C. S. Howe, Pres., Euclid Ave. and Wade Park—machine shop equipment for proposed 4 story, 50 x 220 ft. chemistry laboratory. Estimated cost $300,000.

O., Columbus—Shartle Machine Co., 369 Dublin Ave., G. W. Shartle, Pres. and Mgr. —one large Canton alligator power shear capable of cutting 4 to 5 in. rounds.

O., Marion — Jennings Brake & Spring Co., A. J. Jennings, Gen. Mgr.—24 in. lathe, drill press, etc.

O., Sabina—McPherson-Huff Tool Co., W. L. Huff, Mgr.—drill press, medium size, small lathe and other equipment.

O., Wapakoneta — Sheets-Dunsmore Mfg. Co., C. W. Timmermeister, Gen. Mgr.—automatic turning machine, buffing and polishing machine, drill press and other equipment.

Pa., Johnstown—Lorain Steel Co.—one 20 ton, 66 ft. span overhead electric crane.

Africa, New South Wales, Ashfield — E. G. Andrews, 79 Queen St.—machinery suitable for the manufacture of quarry machinery, gary saws, carborundum machines, stone planers, rubbing beds, floats, polishing machines, etc. and all other machines for stone, marble or granite working, also machinery for the manufacture of cylinder type pneumatic hoists. Reference, Standard Bank of South Africa, New Fork, as agent for Bank of New South Wales.

Opportunities for Future Business

California—Bethlehem Steel Co., 215 Market St., San Francisco, is having plans prepared for distribution plants at San Francisco, Los Angeles and Portland, Ore. or Seattle, Wash. Estimated cost $150,000 each.

Calif., Azusa — Azusa Foothill Citrus Assn., is having plans prepared for a 1 story, 118 x 120 ft. shop and storage building. R. H. Orr, Corporation Bldg., Los Angeles, Archt.

Calif., Los Angeles — A. M. Castle Co., 2064 East 37th St., awarded contract for a 4 story, 75 x 500 ft. steel plant on 55th St. Estimated cost $350,000.

Calif., San Francisco—W. R. Ames Co., 450 Irwin St., awarded contract for a 1 story sheet metal shop at Hooper and 7th Sts. Estimated cost $20,000.

Calif., San Jose—S. J. Buick Co., c/o Binder & Curtis, 35 West San Carlos St., Archts., having plans prepared for a 2 story garage, etc. at First and Reed Sts. Estimated cost $150,000.

Calif., Whittier—H. C. Smith Mfg. Co., awarded contract for a 70 x 220 ft. machine shop, 60 x 100 ft. welding shop, 60 x 125 ft. warehouse, etc. all 1 story at Sorenson Lane. Estimated cost $90,000. Noted May 17.

Conn., New Britain—Patterson Chevrolet Inc. & Buick Co., 1145 Stanley St., awarded contract for a 1 story, 140 x 200 ft. sales and service station on Stanley St. Estimated cost $125,000.

Ill., Chicago—Continental Can Co., 100 East 42nd St., New York, N. Y., awarded contract for a 5 story, 198 x 200 ft. factory at 35th and Rockwell Sts., here.

Ill., Chicago—Duro Metal Product Co., 2649 North Kildare Ave., awarded contract for a 1 story, 121 x 125 ft. factory for the manufacture of metal spacialties. Estimated cost $18,000.

Ill., Chicago—S. M. Earling, 38 South Dearborn St., plans the construction of a 2 story, 80 x 230 ft. garage at 5733-39 Broadway Ave. Estimated cost $75,000. Fox & Fox, 38 South Dearborn St., Archts.

Ill., Chicago — Hannifin Mfg. Co., 621 South Kolmar St., manufacturers of air chucks, awarded contract for a 2 story, 75 x 116 ft. addition to factory. Estimated cost $35,000.

Ill., Chicago—Link Belt Co., 329 West Pershing Rd., awarded contract for a 1 story, 120 x 220 ft. factory for the manufacture of elevators, conveyors, locomotive cranes, etc. Estimated cost $60,000.

Ill., East St. Louis—Southern Malleable Iron Co., 21st and Bond Ave., awarded contract for a 1 story, 85 x 279 ft. addition to iron foundry at 21st St. and Bond Ave. Estimated cost $40,000.

La., New Orleans — Clarke Garage Co. Inc., will soon award contract for a 4 story, 88 x 120 ft. garage on South Rampart St. Estimated cost $150,000. Favrot & Livaudais, Hibernia Bank Bldg., Archts. $150,000.

Me., Portland—Portland Water Dist., 16 Casco St., will soon award contract for a 2 story, 50 x 325 ft. garage and shops near Brighton Ave. J. C. and J. H. Stevens, 477 Congress St., Archts. Noted Apr. 19.

Md., Baltimore—National Casket Co., 821-27 East Lombard St., will build a 1 story, 67 x 80 ft. addition to plant. Estimated cost $25,000.

Mass., Cambridge (Boston P. O.)—Cambridge Salvage & Supply Co., 91 Broadway, is having revised plans prepared for a 2 story, 80 x 100 ft. factory at Broadway and Jordan Pl. Estimated cost $70,000. N. R. Willard, 402 Massachusetts Ave., Arlington, Archt. Noted May 3.

Mass., Cambridge (Boston P. O.) — W. Crane, 1 Hayward St., awarded contract for a 1 story, 90 x 105 ft. factory at Carlton and Amherst Sts. Private plans.

Mass., Framingham—C. E. McGrady is receiving bids for a 1 story, 110 x 135 ft. repair shop and service station, at Union Ave. and Mt. Wayte Rd. Estimated cost $60,000. Rosenblatt Bros., Mallaney Bldg., Archt.

Mass., Gloucester—Independant Fish Co., Wharf St., will build a 1 story machine shop. Private plans.

Mass., North Andover (Lawrence P. O.) —Davis-Furber Machine Co., Water St., awarded contract for a 2 story addition to foundry.

Mich., Detroit — Briggs Mfg. Co., 11631 Mack Ave., awarded contract for a 5 story, 180 x 370 ft. factory for finishing and storage of automobile bodies on Warren Ave.

Mich., Detroit—Chrysler Motor Co., 341 Massachusetts Ave., awarded contract for a 1 story, 110 x 1,000 ft. auto assembly plant on East Jefferson Ave.

Mich., Pontiac—A. Riker, 51 Cherokee Rd., is having plans prepared for a 6 story garage, etc. Estimated cost $600,000. Malcolsom & Higginbotham, 1219 Griswold St., Detroit, Archts.

Miss., Laurel — Eastman-Gardiner Co., plans to rebuild lumber plant recently destroyed by fire. Estimated cost $1,000,000.

Mo., Leeds—General Motors Co., General Motors Bldg., Detroit, is having plans prepared for a 1 and 3 story, 462 x 481, 161 x 200 ft. and 42 x 208 ft. assembly plant here. Estimated cost $1,500,000. A. Kahn, Marquette Bldg., Detroit, Mich., Archt.

Mo., St. Louis—Associated Motors Terminals, c/o W. King & Associates, 117 South Broadway, awarded contract for a 6 story, 80 x 100 ft. garage at Seventh and Morgan Sts. Estimated cost $200,000.

N. Y., Brooklyn—J. Meller, 1208 Eastern Parkway, had plans prepared for a 1 story, 45 x 180 ft. garage and service station at Coney Island Ave. and Day Court. Estimated cost $40,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—Natalma Realty Corp., A. W. Norek, Pres., 66 Court St., had plans prepared for a 2 story, 124 x 125 ft. garage at 88th St. and 4th Ave. Estimated cost $80,000. H. J. Nurick, 44 Court St., Archt.

N. Y., New York—Arch Roof Construction Co., Inc., L. Davidson, Pres., 104 West 42nd St., will build a 1 story, 100 x 198 ft. garage at 237th St. and Putnam Ave. Estimated cost $120,000. Private plans.

N. Y., New York—Aultwood Construction Co., J. G. Nees, Pres., 689 East 239th St., will build a 1 story, 75 x 100 ft. garage at Bronx Blvd. and 236th St. Estimated cost $50,000. J. P. Bayland, 305 East Kingsbridge St., Archt.

N. Y., New York—Clare Holding Corp., O. Pederson, Pres., 330 East 149th St., had plans prepared for a 1 story, 99 x 236 ft. garage at 151st St. and Park Ave. Estimated cost $100,000. Moore & Landsiedel, 148th St. and 3rd Ave., Archts.

N. Y., New York—Pascal Holding Corp., J. De Pasquale, Pres., 3550 White Plains Ave., had plans prepared for a 2 story, 100 x 100 ft. garage at White Plains Ave. and Bronxdale. Estimated cost $50,000. C. N. Whinston, Bro., 2 Columbus Circle, Archts.

N. Y., New York—E. D. Rosenberg, 3150 Rochambeau Ave., had plans prepared for a 2 story, 132 x 132 ft. garage and service station at 205th St. and Webster Ave. Estimated cost $150,000. Moore & Landsiedel, 148th St. and 3rd Ave., Archts.

N. Y., New York—Useful Realty Co., Inc., M. Goldstein, Pres., 277 Broadway, had plans prepared for a 1 story, 100 x 147 ft. garage at Southern Blvd. and 139th St. Estimated cost $75,000. Springsteen & Goldhamer, 40 East 49th St., Archts.

N. Y., Syracuse—Bd. of Contract & Supply, will receive bids until May 29 for 2 story, 97 x 143 ft. shops for water department on Erie Blvd. Estimated cost $100,000. N. F. Pitts, Jr., State Power Comn., Engr. Noted Mar. 29.

N. C., Thomasville—J. M. Bryant, Wilmington, has acquired the lumber plant of G. E. Carter here and plans to expend $75,000 for extensions and improvements.

Okla., Tulsa — Ketchum Hotel Co., is having plans prepared for a 6 story, 100 x 140 ft. garage. Estimated cost $100,000. L. I. Shumway, 712 Alexander Bldg., Archt.

Pa., Pittsburgh — Heppenstall Forge & Knife Co., 4620 Hatfield St., awarded contract for a 1 story, 100 x 200 ft. addition to factory on Butler St. Estimated cost $50,000.

Pa., Pittsburgh—The Hubbard Co., 62nd and Butler Sts., awarded contract for a 1 story, 100 x 200 ft. addition to plant. Estimated cost $40,000.

Pa., Pittsburgh—Miller Saw Trimmer Co., Russ Ave. and Water St. awarded contract for a 1 and 2 story, 200 x 300 ft. factory at Walker and Reedsdale Sts. Estimated cost $350,000. Noted Apr. 26.

R. I., Providence — D. M. Watkins Co. Inc., Pine St., manufactuers of jewelers' supplies, awarded contract for a 2 story, 40 x 95 ft. factory. Estimated cost $45,000.